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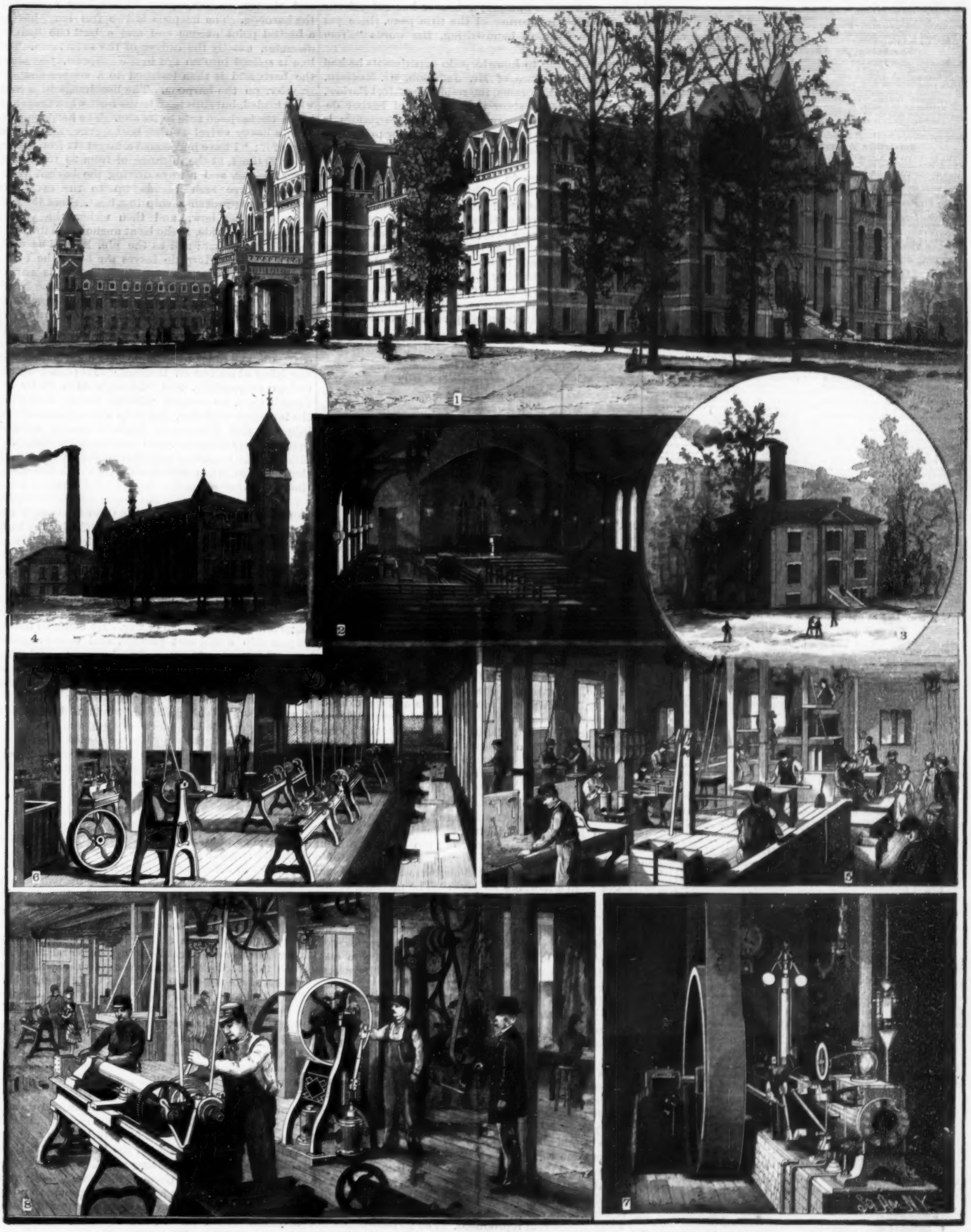

1. General View of Main Building. 2. Chapel. 3. Steam Laundry. 4. Boiler House and Workshop. 5. Wood Working. 6. Machine Shop. 7. Corliss Engine. 8. Iron Working.

THE MILLER MANUAL LABOR SCHOOL OF ALBEMARLE, VA.—[See page 373.]

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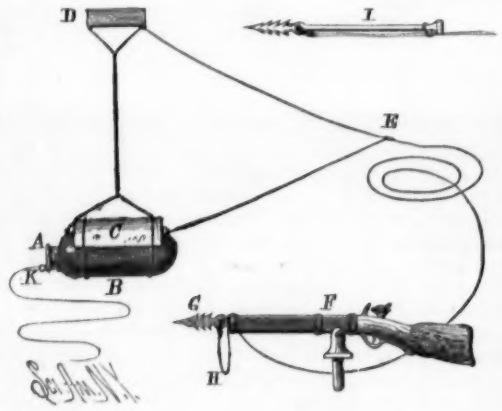
TORPEDOES EIGHTY YEARS AGO.

Among the rare books catalogued for sale in the Brinley collection is one entitled "Torpedo War and Submarine Explosions," by Robert Fulton, published in 1810 by William Elliot, of No. 114 Water Street, New York. The text of the book appears in the form of a letter addressed "To James Madison, Esq., President of the United States, and to the Members of both Houses of Congress;" but it is not dated, and its date can only be surmised as having been 1808 to 1810. In size the book is a quarto cap, bound in a thin marbled paper. It contains 60 pages and five full page plates, and it is in a well preserved condition. It was evidently an author's presentation copy, for though some autograph hunter has cut off the upper right hand corner of the title page, there yet remain, in Fulton's handwriting, the words "From the author."

After referring to some torpedo experiments he had made in the presence of Mr. Jefferson, Mr. Madison, and others, at Kalorama, the residence of Joel Barlow, Fulton proposes to show that a system of harbor defense based on stationary and movable torpedoes is the surest, quickest, and cheapest plan for protecting our maritime cities against the naval forces of an enemy.

He first tells how, in October, 1805, he blew up the brig Dorothea in Walmer Roads, near Deal, within a mile of Walmer Castle, the residence of Mr. Pitt, then Prime Minister of Great Britain. He says that two torpedoes were prepared, one containing 180 pounds of powder. They were united by a rope 80 feet long, and were made to float about 15 feet below the surface, the brig drawing 12 feet of water. Two boats, each having a torpedo in the stern, started about a mile above the brig on the ebb tide, and, keeping as far apart as the connecting rope permitted, they



approached the brig on opposite bows. As soon as the brig's anchor buoy was passed, the torpedoes were dropped overboard, and the tide then carried them down to the brig. The clockwork had been set to explode the torpedo in 18 minutes; and, punctually on time, the explosion occurred, completely wrecking the brig, which parted in the middle and went down. There were present a great many British naval officers, including Admiral Holloway, Sir Sidney Smith, Captain Owen, Captain Kingston, and Lord Keath; and Fulton naively congratulates himself on having made the experiment in the presence of a hundred brave officers of the royal navy; "for," he says, "should Congress adopt torpedoes as a part of our means of defense, Lord Melville, Castlereagh, and Mulgrave have a good knowledge of their combination and effect;" and he predicts that none of the officers present would feel much disposed to "enter the waters of a nation who should use such engines with energy and effect." In a footnote he says: "The morning of my first interview with Earl St. Vincent he was very communicative. I explained to him a torpedo and the Dorothea experiment. He reflected for some time, and then said Pitt was the greatest fool that ever existed, to encourage a mode of war which they who commanded the seas did not want, and which, if successful, would deprive them of it."

Fulton then goes on to describe two or three styles of torpedoes, both fixed and movable. Even thus early in the history of torpedoes he realized the necessity of protecting fixed torpedoes by heavy ordnance fire, since otherwise, he says, "the enemy might send out boats to sweep for and destroy the torpedoes." He proposed to provide fixed torpedoes with a clock attachment which could be set for any period, during which they would be exploded by the contact of any heavy body. At the end of the desired term, the clockwork would allow them to come to the surface, and at the same time would lock their exploding apparatus, so that they could be handled without fear.

But Fulton's torpedo designs were not limited to merely defensive purposes. He elaborated and described a very ingenious offensive torpedo, a cut of which is herewith reproduced. The torpedo consists of a copper case, B, to contain 100 pounds of powder, or more; a cork cushion, C, to give the torpedo such buoyancy that it will weigh only two or three pounds more than the water it displaces; a cylindrical brass box, A, seven inches in diameter and two inches deep, in which there is a gun lock and short pistol barrel to be loaded and used to fire the charge in B; in A there is also clockwork, which, when wound up, may be set to pull the lock trigger and explode the torpedo within any desired number of minutes; at K is a pin, which holds the clockwork inactive, and a light line is attached to this pin; a pine box, D, floats on the surface, and from it the torpedo is suspended at a depth proportionate to the draught of the vessel to be attacked. To the torpedo and the float are attached two lines about 20 feet long, united at E, and thence one line, about 30 feet long, extends to the harpoon. The harpoon is two feet long, having a barbed point at one end and a butt one inch in diameter, exactly the caliber of the swivel gun. The line is spliced into an eye in the harpoon, just abaft the barb, and is then fastened to a copper ring, or traveler, on the harpoon. The line hangs in a loop when loaded, but slips back to the butt when fired, and keeps the harpoon true to its aim. The harpoon gun, F, is a heavy swivel gun for boat service, and Fulton says of it: "I have harpooned a target six feet square 15 or 20 times, at the distance of from 30 to 50 feet, never missing, and always driving the barbed point through three inch boards up to the eye." He proposes to approach a ship in a boat, shoot the harpoon into her bow, and then either the vessel's headway or the tide, if she be at anchor, will draw the torpedo under her; and as the pin, K, will be withdrawn when the torpedo leaves the boat, the clockwork will explode the torpedo when it is snugly pressed against the ship's bottom.

In 1805, Fulton, being in England, induced some of the British naval officers to make practical trials of his torpedoes. Accordingly, October 1, 1805, Captain Siccombe took a galley, manned by eight men and a coxswain, and ran across the bows of a French man of-war lying at anchor off Boulogne. He placed his torpedoes successfully, and although fired at by the French crew, he escaped without harm. But when the torpedoes exploded, the ship was apparently uninjured; and Lieutenant Payne's similar attempt upon another French vessel was no more successful, although the torpedoes exploded according to expectation. Fulton then discovered that the torpedoes, though carried alongside the ships, did not come in contact with the hulls, but hung nearly vertically alongside, at a distance of from ten to twenty feet from the bottom. To obviate this difficulty, he hung the torpedo in a bridle, with one leg longer than the other, so that it would stand at an angle with the keel and be pressed in against the ship's bottom.

Fulton then made an elaborate calculation to show how much better and cheaper it would be to depend upon torpedo boats to protect our harbors than up on large and expensive men of war. He assumed that an 80 gun ship would cost $400,000, and would require a crew of 600 men. He allowed twelve men to each of his proposed torpedo boats, and thus 600 men would man 50 boats. These 50 boats with torpedoes and all other equipments would cost only $24,300, or $375,700 less than the 80 gun ship; and he would thus be able to fit out 839 torpedo boats for the cost of one 80 gun ship. Having then calculated just how close the boats would have to come to a ship, how fast they could row, and the length of time after discovery that they would be under fire, Fulton reached the conclusion that 50 torpedo boats would be able to destroy one ship before all of them were destroyed by the ship.

Fulton seems to have overlooked the possibility of his harpoon lines being cut as fast as they were fixed; but his general ideas in favor of torpedoes were, like most of his other inventions, considerably in advance of his time. In one chapter of his pamphlet he treats of "Thoughts on the Probable Effect of this Invention," and, among other things, says: "Convince the people of Europe of the power and simple practice of these engines, and it will open to us a sublime view of immense economy in blood and treasure." Just think of the enormous outlays of Europe on navies of the present day, in spite of the general belief in the "power and simple practice" of torpedoes!

In another chapter he reviews the condition of the English navy for two centuries previous. Thus in 1602 it contained only 42 ships, carrying 180 guns and 8,376 men. At the death of James I., in 1665, it contained 62 sail, and its annual cost was £50,000 sterling. At the death of King William, in 1701-02, there were 256 ships, carrying 9,300 guns and 52,000 men, the annual cost being £1,046,397 sterling. In 1801 the royal navy contained 945 ships, carrying more than 100,000 men and costing £13,654,013 sterling per annum. Fulton thence argues that if the United States should adopt the policy of creating a sufficient navy to protect ourselves against Great Britain, we should involve ourselves in constantly augmenting expense; and even though we increased our navy to the utmost that our revenues would permit, we should still be inferior to many other nations. He estimated—on the basis of a population of about 5,000,000 in 1800 and of a doub-

ling every 30 years—that in 1890 we should have a population of 40,000,000; and he allowed England and Scotland about 18,000,000 by the end of this century.

Then he makes a calculation that even in time of peace the British navy must cost £10,000,000 a year, which would amount to £250,000,000 sterling in twenty-five years. This sum, he says, which the United States would have to spend to keep up a navy equal to England's, could be laid out in building twelve canals, each 1,500 miles long, running north and south, and thirty canals, each 600 miles long, running east and west, at distances of 50 miles apart. These, at the rate of £3,000 sterling per mile, would cost £108,000,000. Then he suggests 2,000 bridges at £30,000 each, equal to £60,000,000, and 2,050 public schools at £40,000 each, making £82,000,000. This would exhaust the £250,000,000, and he thinks this would be a far better use for the money. "Say, legislators," he continues, "you who direct the destinies of this great nation, shall Americans, like servile creatures of established habits, imitate European vices, or copy them because they are familiar? Shall they nourish a useless marine, lay the basis for its increase, and send it down the currrent of time to futurity with all its complicated evils?" Fulton's anxiety on this point would have been greatly increased if he could have looked down the current of time far enough to see the United States navy in 1886. But, as already stated, Fulton was almost wise enough to be a prophet, and this little book proves it.

A CONVENIENT AND CERTAIN MODE FOR TEMPERING STEEL.

Mr. James A. Peck, of Brewsters, N. Y., mechanical engineer of the N. Y. Condensed Milk Co., gives us the following method discovered by him, and which he uses with great success for tempering all kinds of tools, knives, razors, steel dies, and other implements.

Take a suitable quantity of muriatic acid, dissolve all the zinc the acid will take.

Prepare a tempering bath composed of one part of the above zinc acid and one part water.

Heat the steel according to its hardness.

If high or hard steel, heat until just red and then temper in the acid bath.

If low steel, heat it as hot as you would to temper in water, then temper in the acid bath.

After immersing in the acid bath, cool off in water.

For lathe and planer tools draw no temper; but for other tools draw temper. Unlike water tempering, the colors that appear under this method give no clew to the hardness.

By this process, steel is readily hardened to any desired degree, and may be made to cut glass like a diamond.

If desired, an acid bath composed of two parts of muriatic acid and one part water may be used. Mr. Peck, however, prefers the zinc acid, as being more dense.

A prominent advantage of this method of tempering is the certainty and excellence of its results. It never fails to yield the temper required. It can be relied upon for every description of steel or tool.

Destruction by Nitro-glycerine Explosions.

An "old oil operator" in the Bradford oil region thus rehearses in the New York *Times* some facts as to glycerine explosions which are certainly mysterious, and have been observed many times:

"Attending the frightful deaths that so frequently follow the handling of nitro-glycerine in the oil regions, there is one feature the mysterious nature of which is startling. It has puzzled scientific observation and study, and I do not believe to-day that any satisfactory explanation can be given of it. This singular feature is the almost complete annihilation of matter, especially of the human body, which in a majority of cases results from a fatal explosion of this compound. I have noticed that in many instances. I had a teamster in our employ once named Henry France. Like all men of his kind in the oil country, there was nothing either above, below, or on the earth that he feared. He was in the habit of carting nitro-glycerine to any well where I wanted to use it, and he and his partner Warren Jack actually got so reckless in handling the deadly stuff that no other help I had would remain at work when they knew France and Jack were coming in with a load of glycerine. These two men were so callous to fear that they used to unload the stuff as they would a load of bricks, France standing in the wagon and throwing a can to Jack, who stood some feet away, and Jack catching it and placing it on the ground in time to catch the next one his companion tossed him.

"As it takes a man with a good set of nerves to even ride in a wagon when he knows there is nitro-glycerine under the seat, this manner of handling a compound that the slightest jar frequently explodes will give an idea of the sort of nerves these two men had. One day in 1880 France was coming in with a load of glycerine, and when he was within a quarter of a mile of the well we heard an explosion. No one ever knew how it happened, but it was one of the most complete cases of nitro-glycerine annihilation I ever saw. We found the usual cellar that a few cans of glycerine always digs in the ground when it goes off, and the usual area of timber felled. Over 300 ft. off in the woods, to the right of the road, we picked up a wagon tire. We found the tail of one horse and the hoof of another. In another part of the woods a man's knee was picked up, and that was all we ever found, except Henry France's greasy cap lying by the side of a stump and his silver watch hanging on the limb of a tree.

"George Doran was blown to pieces by a nitro-glycerine explosion at Red Rock a few years ago. He was a man that weighed 200 pounds. All that the most thorough search ever recovered of that 200 pounds of flesh and bone was a part of one of the poor man's feet—less than one pound. Charles Berridge, a well known oil man, was blown up by nitro-glycerine one winter in Allegheny County, The ground was covered with newly fallen snow. On either side was a high and abrupt hill only a few rods apart. Berridge was a very tall man, and his weight was 180 pounds. The remains of the poor fellow were searched for carefully, but less than 15 pounds of them could be found. The most curious part of the case, and one showing how completely annihilation accompanies an explosion of nitro-glycerine, was this: The greatest force of the explosive is always expended upward. However infinitesimal the atoms to which Berridge's body might have been reduced by this explosion, in falling back upon that spotless snow some trace of them must have been seen, but the snow remained as spotless as before. Besides human bodies, the iron frames of wagons, and even the ponderous nitro-glycerine safes, have been removed from human vision by an explosion as effectually as if they had never been formed, and the mystery of their utter annihilation cannot be explained."

Heating Water Rapidly.

In the SCIENTIFIC AMERICAN, October 30, is a communication from Mr. Thos. Pray, Jr., referring to his use of studs on steam and water boilers. It is evident from the wording of his remarks that he has not read the full report of my experiments. Projecting studs, such as he sketches, have been used in this country, to a limited extent, for over twenty years, but they were, like his, so proportioned as not to permit of the possibility of flame contact, which was shown by my experiments to exist only with studs not less than four diameters long, if the studs were made of copper.

The extraordinary increase of duty with properly proportioned studs was measured, and proved to be, surface for surface, six times that of an ordinary flat surface, and as a matter of actual practice we are now making simple boilers to boil any quantity of water in any specified time, almost without limit to the speed. The inclosed extract from *Industries* will, I think, establish my position as to the originality of the experiments, and also show their possible commercial value.

THOS. FLETCHER, F.C.S.

Warrington, England.

The following paper explains Mr. Fletcher's views more fully:

THE IMPENETRABLE COLD ZONE IN STEAM BOILERS.

BY T. FLETCHER, F.C.S.

During my experiments on the state of things in that almost unknown space between a flame and a vessel containing water, some most extraordinary facts have come to light, which are not only of the greatest importance to steam users and boiler makers, but explain many curious points in connection with the heating of water.

It is well known that a flame does not come in contact with any ordinary vessel containing water, and that a paper label will remain on the bottom of a tin or copper kettle placed on a sharp fire, until by drying it gradually becomes loosened, and loses its contact with the metal, and so becomes burnt. I have myself seen labels on the bottoms of ordinary kettles and pans, the labels being quite perfect after some weeks' use over gas burners and fires. The work obtained from any source of heat by a limited surface is in direct proportion to the difference between the temperature of the vessel and that of the source of heat in absolute contact with it, and it therefore becomes a matter of serious importance to discover what the actual temperature of this cool and flameless zone is, and whether it can be removed. As is no doubt well known, my efforts to remove this, which is practically a wet blanket, from between the vessel and the fire have been partially successful by the use of projecting studs or webs of definite proportions, and the experiments already published prove that at the ends of copper rods four diameters long, flame contact exists, at all events sufficient to char paper, and to multiply the available duty, surface for surface, six times as compared with either water tubes or ordinary boiler plates, and that the evaporating power of any properly proportioned studded or ribbed plate has no limit except the practical one of removing the steam quick enough to prevent it lifting the water bodily out of the boiler.

After proving beyond doubt that under ordinary conditions flame does not come in contact with a vessel containing water, I endeavored to get this contact, and the corresponding increase in evaporating power, by directing flame against the water vessel with the assistance of a powerful blast, the result being, much to my surprise, that I found an impenetrable cold zone surrounding the vessel, absolutely impassable, not only to a powerful blowpipe flame, urged with an air blast of 1¼ lb. per square inch pressure (the heaviest blast a gas blowpipe will stand under ordinary conditions), but that it was equally impassable by radiant heat from a sheet of white hot platinum, held as close as possible without absolute contact. In making these tests, the result was proved by the fact that sheets of paper pasted on the water vessels were exposed to both the direct impact of the blowpipe flame and also to the radiant heat from the platinum, until the water in the vessel boiled, the paper being perfectly free from charring or discoloration at the end of the test.

Another important fact came out as the result of these experiments. Not only can the maximum temperature be determined by the presence or absence of charring of known organic substances, but also the thickness or depth of the cold zone can be measured by using paper of different thickness pasted to the surface of the vessel. When the paper used is thicker than the depth of the cold zone, the surface is charred or completely burnt to an invariable depth by each source of heat; but if this charred surface is cleared off with glass paper, the under part will be found perfectly white and clean, and on again directing the flame on this clean surface, it remains untouched.

This cold zone, although impassable by flame, hot air, or radiant heat, is powerless to resist the carrying of heat through it by solid bodies; and while the blowpipe flame is being directed on the paper without the slightest effect, a wire passing through the flame and touching the paper will burn it instantly and completely, although the actual temperature of the wire must of necessity be far below that of the blowpipe flame.

The extraordinary part of the whole series of experiments seems to be the existence of a zone of cold against all surfaces of metal having water behind them, this space being, to radiant heat and flame, almost as impenetrable as the metal itself is to the water. Some heat certainly does pass, or the water would never boil; but the quantity which does make its way through is very trifling as compared with what would pass, and, in fact, what does pass, under such conditions as permit of direct flame contact with the metal.

The result of these experiments does not fit the ordinary accepted theories of radiation and absorption of heat. The fact is that the high temperature stops suddenly at a very clearly defined distance, the division line being sharply drawn. It cannot be said that the heat is absorbed at a sufficient speed to produce this cold zone, because, as a matter of fact, the heat rebounds and is dissipated to a large extent sideways, and this rebound takes place at an invariable distance from the vessel, irrespective of the angle at which the flame is driven, and depending only on the force of impact of the flame. If we could imagine the surface of the vessel covered with a layer of elastic material which is compressed by a torrent of small shot driven steadily against it, we get a mechanical representation of the actual state of things between a flame and a cold vessel, additional force of impact reducing the thickness of the elastic layer, but being powerless to annihilate it.

The Mechanical Engineers' Convention.

During the week ending December 4, the Convention of Mechanical Engineers was held in New York. The headquarters were at the New York Academy of Medicine. At the business session on November 30, the following officers were elected: President, George H. Babcock, New York; Vice-Presidents, Joseph Morgan, Jr., Johnstown, Pa., Charles T. Porter, New York, and Horace S. Smith, Joliet, Ill.; Managers, Frederick G. Coggin, Lake Linden, Mich., John T. Hawkins, Taunton, Mass., and Thomas R. Morgan, Sr., Alliance, O.; Treasurer, William H. Wiley, New York.

During the week visits were made to different places of interest, to Clark's Thread Works and other factories, and Edward Weston's private laboratory, in Newark; to Bedlow's Island and the statue of Liberty; and on December 2 a meeting was held in Stevens Institute, Hoboken. One of the most suggestive papers read treated of Capital's Needs for High Priced Labor. It was read by W. E. Partridge, Esq. The author took the ground that a cheapening of the product could be obtained by the use of high priced operatives.

The paper was discussed, and in the main the members coincided with the author in his views. Among the other subjects may be mentioned the following: Prof. Francis Ruleaux on "Friction of Toothed Gearing," Prof. Thurston on "The Friction of Non-Condensing Engines," and Thomas D. West on "Casting Aluminum Bronze and other Strong Metals." A large number of papers in addition to the above were read, and many discussions of the subjects were indulged in. The attendance was large, 150 members participating in the visit to the Newark factories.

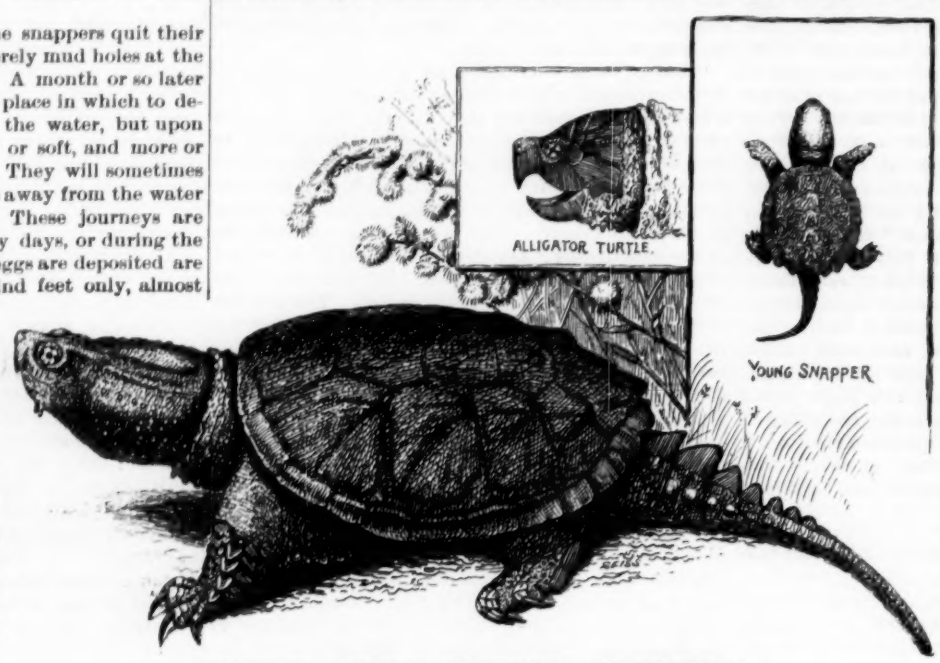
THE SNAPPING TURTLE.

BY C. FEW SEISS.

Although the "snapper," or snapping turtle, is a well known reptile, its life history, owing to its secluded habits, is, as a general rule, but little understood.

It has a long geographical range, being found from Canada to Ecuador, S. A., but is wanting on the Pacific slope of the United States.

During the month of April the snappers quit their winter dormitories, which are merely mud holes at the bottom of some marsh or pond. A month or so later the females search for a suitable place in which to deposit their eggs. This is not in the water, but upon the bank where the soil is sandy or soft, and more or less dry and exposed to the sun. They will sometimes travel a quarter of a mile or more away from the water to find a suitable sandy spot. These journeys are generally made on rainy or cloudy days, or during the night. The holes in which the eggs are deposited are scooped out with the turtle's hind feet only, almost exactly in the same manner as our box or land turtle. While digging, the turtle performs, as it were, a clumsy and slow waltz. The holes are excavated only to the depth to which the leg and foot of the turtle is able to reach. The number of eggs deposited depends upon the size and age of the snapper. From fifteen to nearly double that number have been counted. After the eggs are laid they are carefully covered with sand, and the hole is filled and leveled so perfectly that it cannot be recognized. The eggs vary in size from 1⅛ to 1⅝ inches in length. They are somewhat round or globular in form, and are covered with a tough, leathery skin.



SNAPPING TURTLE (CHELYDRA SERPENTINA).

The little snappers escape from the eggs and dig their way out of the sand, from the middle of June to the 1st of August; and immediately, by direct line, seek the nearest body of water. Instinct seems to tell them the correct route, for they have, I believe, never been found traveling in the wrong direction, although in some instances the water was quite a distance off, and entirely hidden from view.

Great numbers of snapping turtles are sold in our markets. They are served upon the tables of our hotels and eating houses in the form of soup or stewed "snapper," but, I believe, in no other way. For my part, I do not consider it a savory dish, and always omit it from my bills of fare. I would suggest snapper salad instead of lobster salad, as the latter valuable animal is becoming so rapidly exterminated. Vinegar and high seasoning might destroy that somewhat rank and musky flavor which snapper generally possesses.

I have noticed on several occasions the mode practiced by some farmers of "fattening" snappers previous to killing them for the pot. After they are caught they are kept for some weeks in the tank or hogshead containing sour milk, kitchen slops, etc., which is kept for feeding the hogs. It is not natural that such unsavory surroundings should produce much fat, and it certainly does not add to the health and happiness of the captive turtle.

The snapper has a voracious appetite. Everything in the animal line that he is able to master is included in his menu. To the breeder of ducks and geese he is a great pest. Rising stealthily beneath the swimming duckling he seizes it by the feet, pulls it under the water, and drags it off to some convenient spot, where it is devoured. The snapper also has the habit of lying in wait for its prey in some secluded hole under the bank; and when a fish, young muskrat, eel, or frog passes his retreat, he darts out his long neck, and, simultaneously throwing his whole body forward, catches in his jaws the unsuspecting victim. Although carnivorous in habits, the snapper has been known to pull and eat berries from bushes which overhung the water.

The snapping turtle is remarkably tenacious of life. Its head, though completely severed from its body, will seize with its jaws a stick or other object that is placed near enough for it to grasp. Indeed, I have seen a head that was able to use its jaws the day after it had been detached from its body.

The shell or carapax of the snapper adult measures from 9 inches to over 2 feet in length. Dr. De Kay gives 4 feet as the maximum size, but I have never known one so large. An old individual caught in the Schuylkill River above Philadelphia weighed 24 pounds, which was considered very large for this locality.

There are two species of snapping turtles found in the United States—the one here described (*Chelydra serpentina*) and the great-headed or alligator snapper (*Macrochelys lacertina*), found only in the Mississippi River, its tributary streams, and the rivers of the Gulf States. The latter can be distinguished by its enormously large head, which is covered with smooth, symmetrical plates, while the head of the common snapper is covered with a rather rough but soft skin.

WEIGHING A GAS.

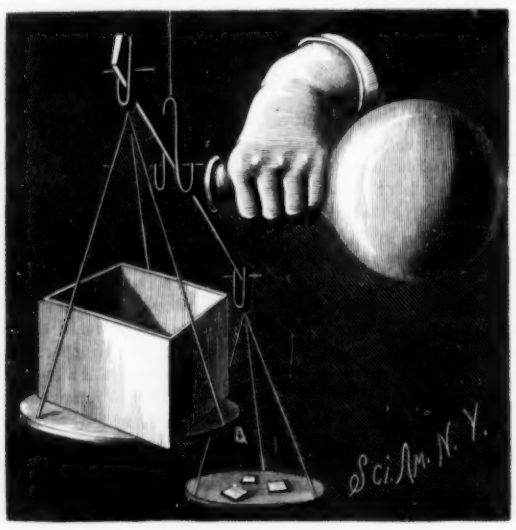
T. O'CONOR SLOANE, PH.D.

The identical action of steam and water in the reaction engines named Barker's mill and Hero's engine has already been used to illustrate the possession of mass by fluids and gases. Mass acted on by gravity produces weight; therefore, if the possession of absolute weight by a gas be shown, another demonstration in the same line is produced. In the cut is illustrated a simply constructed apparatus for proving that carbonic acid gas possesses weight. It consists of a delicate balance provided with a box or receptacle for the gas and with a weight or taring pan. It is thus constructed.

A thin piece of wood is used for the beam. A piece three feet long, two inches wide, and an eighth or a quarter of an inch thick is good. Through the center of one of the sides a longitudinal line, which must be perfectly straight, is drawn. This determines the position of the fulcrum and of the supports of the balance frame. The center of the line is found, and a needle is driven through it as nearly perpendicular to the plane of the wood as possible. The easiest way to insert it is to first make a hole part way through with the small blade of a penknife. Then, with a pair of pliers, the needle can be grasped and forced through. The point for about an eighth of an inch should now be broken off, lest it prove annoying.

At each end a needle is passed through the beam in the same way, care being taken to keep them exactly on a line with the center one, or a little below it. This amount should not exceed the diameter of the central needle. The best plan is to try to have them all on one line.

This gives the beam for a balance. The suspension



WEIGHING A GAS.

piece is made of tin, bent into a U-shape, with its ends turned back upon themselves. Holes are made for the needle to go through. Notches are made in the upturned ends. This is not strictly necessary, as it is enough if the ends are bent so as to come exactly on a line with the bottoms of the apertures in the tin. Both ends and the two apertures must be on the same line. This piece is sprung over the needle, so that it shall extend across both upturned ends, as shown in the cut, and the suspension piece is provided for.

Similar pieces of tin are arranged for the end needles, but these need no retractile ends. Balance pans, made of light wood or cardboard, are suspended from these end pieces. The great object is to keep the whole construction as light as possible. A box for holding the gas is made out of light, stiff paper, to rest on or take the place of one pan. A tight brown paper bag is as good as anything for this purpose. A clew to its size may be found in the sensitiveness of the balance. One hundred cubic inches of carbonic acid gas weigh about 17 grains in excess of the air displaced. By trying it with weights, the minimum weight with which the balance will turn can be found. Enough cubic inches of carbonic acid gas to far exceed this in its effective weight should be allowed for. Thus, if it is found that the balance turns well with 17 grains in one pan after it has been brought into exact equilibrium, 100 cubic inches of gas would be none too much. The rule is, of course, the more gas used the better, because it will weigh more.

The gas is made by the action of hydrochloric acid on limestone, and is collected by displacement of air in a flask with as wide a neck as possible. The quantity formed is ascertained by lowering a small flame, such as a taper, or even paper alumette, into the flask. The point where this is extinguished marks the level of the gas. When the flask is completely filled, it is corked or covered with a paper cap.

The balance is now accurately tared, the box or bag being in its place. The flask is uncorked and the gas poured into the bag. As nothing can be seen, the surest way is to turn the flask at once nearly over, with its neck below and within the edge of the mouth of the box. As the gas pours in, if the hand is placed in the current, it can be felt. The gas gradually enters the box, and in a few seconds that side of the balance preponderates, and descends. For its simplicity, few experiments are more effective.

The weight of the gas can further be illustrated by pouring it into tumblers or beakers. From them, by means of straws or glass tubes, it can be taken into the mouth, producing the well known soda water taste.

This experiment is usually shown in chemical courses, but it really belongs to physics. The supposition is that a certain knowledge of chemistry is needed to make the gas. But this is easily done by any one, and the method is described in all textbooks of chemistry. A small bottle is fitted with a perforated cork. Some fragments of marble are placed in it, covered with water, and some muriatic acid is added. The gas immediately begins to come off. The cork is placed in the bottle, and by a glass and rubber tube the gas is conducted through the aperture in the cork, and led to the bottom of the flask. There it sinks and rests almost like water.

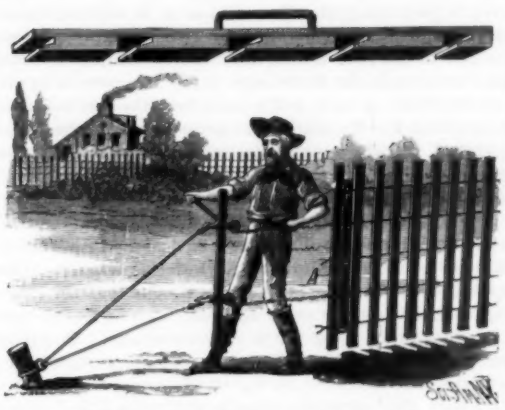
Washboards.

A reporter on the Cleveland, O., *Leader* had a talk with the traveling agent of one of the largest washboard factories in the United States the other day. Said he: "Millions of washboards are made and sold in the United States every year, and at least 7,200,000 are sold yearly between the Allegheny Mountains and Missouri River. There are two factories in Cleveland which turn out 200 dozen washboards a day, one in Toledo which turns out over a million a year. There are at least twenty different varieties of washboards, and the best washboards are made in the West. The Eastern factories make their washboards of pine. The best wood for washboards is the cottonwood or the sycamore. Pine is too soft, and white pine is too expensive. The best washboards are made with dovetailed heads with wire nails driven across the grain of the wood. You can buy the poorer class as low as 80 cents a dozen at wholesale, and the better boards cost as high as $2.15 a dozen. Double washboards are those that have zinc ridges on both sides. The prices of these run from $1.60 to $3 per dozen. At retail washboards cost 25, 30, 35, 40, and 50 cents apiece. The first washboards were made of wood entirely, and our washerwomen used to pound the dirt out of the clothes with a stick by laying them on a board. The first washboards made of zinc were put upon the market about twenty-five years ago, and the style first invented is found the best to-day."

HON. ABRAM S. HEWITT, our new mayor-elect, says that "for the first time in the history of this country, the day's wages of a mechanic can buy a barrel of flour."

IMPROVED FENCE CLAMP.

The object of this invention, which has been patented by Mr. William H. Kirby, of Warsaw, Ky., is to provide a simple, easily applied, and efficient clamp to be temporarily attached to wire picket fences for stretching the panels preparatory to securing them to the post, and for holding them under tension while they are being secured. The clamp, shown in the upper view, is formed of a bar of iron or steel, and is provided with angled notches, which slip down over the wires of the

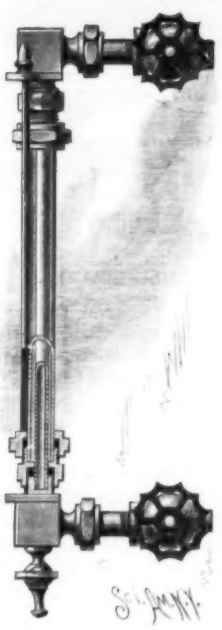


KIRBY'S IMPROVED FENCE CLAMP.

fence between two of the pickets, the number of notches and the distance between them being arranged to correspond with the wires of the fence to be stretched. Secured to the bar are two chains that lead to any convenient mechanism for tightening the panels. After one panel has been strained and secured, the chains are loosened and the bar removed and transferred to a new panel, and so on in the case of each panel of the fence. This improvement does away with all bolts, and consequently saves much time.

WATER GAUGE FOR STEAM GENERATORS.

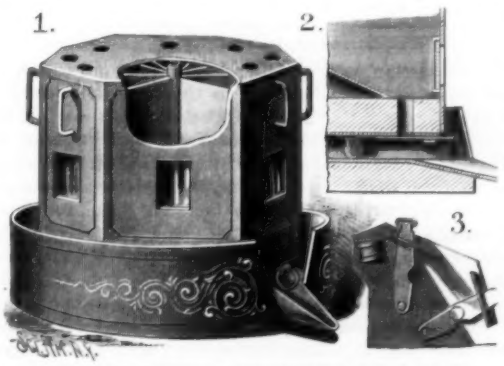
The engraving herewith presented illustrates a water gauge having an inner and outer glass tube, each end of each of which is provided with a suitable stuffing box. This construction obviates the danger of the glass being broken by sudden changes of temperature, as it is liable to be when of the ordinary pattern. A small opening in one of the stuffing boxes admits a slight circulation of air in the space between the tubes; but with this exception the inner tube is perfectly protected by the outer one from violent draughts of cold air, which would otherwise be liable to break it when heated by hot water and steam from the boiler. The tubes are protected by guard rods held in plates formed upon the elbow pipes, connected to the globe valves, in the usual way. The outer tube also serves to magnify the contents of the inner one, so that the condition of the boiler can be more accurately ascertained than with the common single glass.



This invention has been patented by Mr. William Young, of Easton, Pa.

REVOLVING SHOT CASE.

This shot case is so arranged as to hold various sizes or grades of shot and to discharge any quantity, as ordered by the customer. The interior of the holder is divided by radiating partitions into a number of compartments, in each of which is fitted an inclined plate which directs the shot to a discharge hole made through the floor, as shown in the sectional view, Fig. 2. In the top of the holder are holes through which the shot is placed in the compartments, and in the side walls are panes of glass, one for each division, so that the size of the shot can be readily discerned. The holder is so mounted upon a base that it may be revolved, in order to bring either of the compartments over a chute, to deliver any quantity or grade of shot desired. The discharge opening of each compartment is provided with a cut-off lever (shown in the bottom plan view, Fig. 3), by means of which the requisite quantity of shot may be allowed to flow from the holder to the chute, and thence to a bag or other receptacle for delivering to the customer.



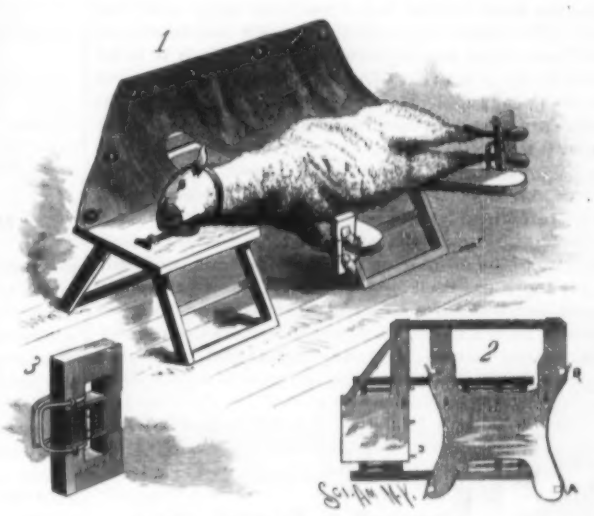
STEARNS & WELLS' REVOLVING SHOT CASE.

This invention has been patented by Messrs. Frank Stearns and George L. Wells, of Creighton, Mo.

SHEEP SHEARING TABLE.

The sheep shearing table herewith illustrated consists of two parts—a main and auxiliary table—supported by suitable legs. The main table is for supporting the body of the sheep, while the other, which is held in the same plane as the first, supports its head. The front corners of the main table are formed with projections, which are each provided with a hook for holding the legs of the sheep, and between the tables is a space through which the front legs of the sheep swing when he is turned from one side to the other in shearing. Hooks are attached to the back of the main table to receive bails of stocks for holding the sheep when turned upon the side opposite to that shown in the engraving. The sheep's head is held to the auxiliary table in such a manner as to permit considerable freedom and give a degree of comfort to the animal while confined for shearing. Secured to the tables in a simple way is an apron, held in an inclined position to receive the wool as it is clipped. The apron is so arranged as not to interfere with the turning of the sheep.

This table furnishes an absolute fastening, for the legs and head, and which can be easily and quickly applied by one person. The sheep is held in an easy position in which it does not suffer nor struggle. The sheep can be instantly turned, without lifting and without breaking the fleece or scattering the wool, and the fleece when wholly removed is ready for tying for market, with the clean side out.



PHELPS' SHEEP SHEARING TABLE.

This invention has been patented by C. B. and J. B. Phelps, of Northville, Cumberland County, Tenn.

Lightning Melts a Lead Water Pipe.

Through the courtesy of Mr. W. F. Stewart, of Hermitage, Pa., we have received an account of the melting by lightning of a lead water pipe on the place of Mr. R. H. Abbey, of Corry, Pa. Water is brought to the buildings from a spring, 80 rods distant, through a lead pipe of half inch bore, at a depth of two feet. Water ceased running about the middle of last May, just after a thunderstorm, and all attempts to force it through failed. In September, Mr. Abbey dug down and found the difficulty to be some 15 rods from the spring, where a section of pipe, 3 or 4 inches long, was found to be melted and fused, so as to be nearly solid. This was cut out and new pipe put in, but still the water failed to run.

Two other melted sections, but not so completely as the first, were found, one about 7 feet above and the other 6 feet below the first. When these had been replaced, a full stream was obtained at the barn. On the west side of the pipe, opposite where it had been melted, the turf had been torn up for a distance of 30 feet or more, and from 1 to 2 feet wide and 6 to 8 inches deep. About 8 feet from the pipe this had forked, one part extending to the middle and the other to the upper fused point. This disturbance had been noticed at the time the water stopped flowing, and "consequently," Mr. Abbey concludes, "when I found the fused pipe, I was satisfied it was the work of lightning."

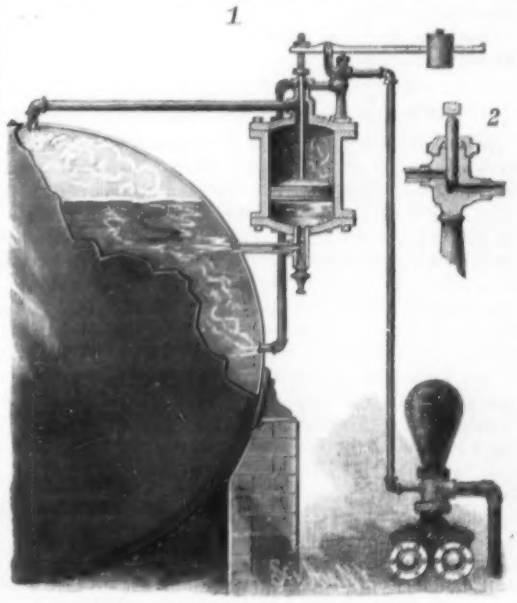
A New Cement from Slag.

Selected blast furnace slag is, while it is in the molten condition, run into water, and is thereby reduced to a fine state of subdivision. To this finely divided slag, after it has been carefully ground and screened, a certain proportion of slaked lime, also passed through a fine sieve, is added, and the mixture is thoroughly amalgamated and ground together in an apparatus called by the inventors a "homogenizer"—an appliance consisting of a revolving drum, partly filled with a certain number of metal balls, resembling somewhat in its action the machinery often employed for quartz crushing. Here the lime and the slag particles are acted upon by the continuous blows of the numerous balls, and are crushed to an extremely fine powder. Moreover, their molecules are mechanically brought into the closest possible contact. By this means it is claimed that a "flowery, silky" powder is produced, capable of filling all the interstices in the materials to be aggregated better than the "sharp, sandy, and granular powder" of Portland cement. Indeed, it is asserted that this treatment will improve Portland cement made in the ordinary way. The process of "homogenizing," as compared with simple mixing, effects a vast improvement in the quality of the slag cement, its tensile and compressive strength being thereby almost doubled. This is the entire process of manufacture.

FEED WATER REGULATOR.

By means of this regulator, which is the invention of Mr. L. P. Foss, of Kalamazoo, Mich., the level of the water in a boiler may be maintained constantly at a uniform height. Inserted in the feed pipe is a valve operated by a float working in a chamber connected with the boiler above and below the water line. The chamber is provided with heads, the lower one of which has a T connected with the boiler below the water line, and also a valve for removing the water from the chamber when desirable. In the upper head is inserted a T communicating with the steam space in the boiler, and the upper end of which is formed with a stuffing box, through which passes a rod carrying on its upper end adjustable nuts. To the upper head is secured a pillar, supporting a valve casing—shown enlarged in the sectional view, Fig. 2—and an arm. The valve serves to close the passage leading from the feed pump to the water space of the boiler. In the arm is pivoted a lever, having a weight on its longer arm, while its short arm enters between the adjustable nuts. This lever operates the valve when steam passes through a stuffing box in the top of the casing.

The pump works continuously, and discharges under a pressure greater than that in the boiler, and the weight is adjusted to counterbalance the float. The water level in the chamber is always the same as that in the boiler, so that the movement of the float will always correspond with the rise and fall of the water in the boiler. When the water level is high, the float rises and permits the weighted arm of the lever to hold



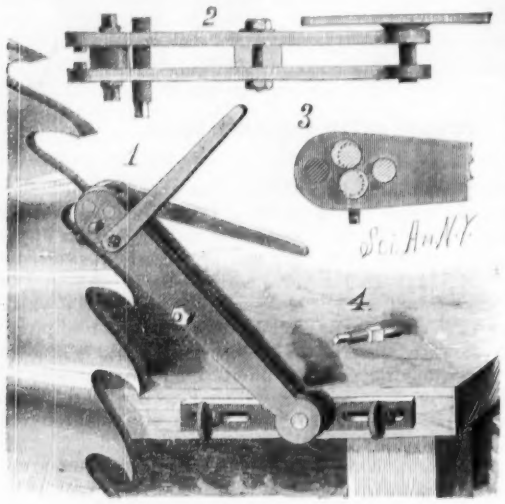
FOSS' FEED WATER REGULATOR.

the valve to its seat, and thereby prevent the flow of water. When the water falls, the float descends, and the water under pressure from the pump raises the valve and opens the passage to the boiler. Should the water, from any cause, continue to flow, the float will rise and bring the lower nut into contact with the short arm of the lever, which will be pressed upward to assist the weight in holding the valve to its seat.

IMPROVED SAW SWAGE.

The frame of the swage consists of two parallel tapering steel plates, held the proper distance apart by a bolt carrying a gauge washer of such thickness that the space between the plates will receive the teeth of the largest saw ordinarily used. The lower ends of the plates are pivoted upon a pin attached to a slotted plate, which is fastened to a filing bench by screw clamps, so that it may be adjusted to different sized saws. Upon the inner faces of the enlarged ends of the saws are serrated jaws, shown in Figs. 2 and 3, which engage each side of a saw tooth, and hold it firmly when the tooth has been entered for swaging. Journaled in the plates at a point slightly above their enlarged ends is an eccentric faced roller, which is revolved by means of a handle attached to one end. This roller is adapted to engage and operate in conjunction with an anvil, circular in form and provided with an eccentric face intersecting its circular bearing face. The anvil is placed immediately under the roller, and is designed to enable the operator to take up any possible wear of the roller resulting from continual use. With this form of anvil the teeth will be swaged with a more or less concaved surface. When it is desired to keep a square front on the teeth, the anvil shown in Fig. 4, having square sides, is employed. The plates are drawn toward each other to make the serrated jaws take firm hold on teeth of varied thickness, by means of a right and left hand screw, which enters correspondingly threaded apertures in the plates, and is operated by a handle.

When the swage is once adjusted to accommodate the saw to be swaged, it will remain stationary until every tooth has been operated upon, except the slight movement necessary to adjust the free end to or remove it from a tooth. The roller and anvils are interchangeable, and can be readily adjusted to work upon either side of a tooth, and can be made in sizes to work



WARD'S IMPROVED SAW SWAGE.

successfully upon any ripping saw, from band to circular. The tooth enters between the roller and anvil when the handle is given a third or half turn to swage the tooth, which is then released and the next one placed in position.

This invention has been patented by Mr. Clarence Ward, of Haring, Michigan.

The Discoverer of Anthracite Coal.

Anthracite was discovered in Pennsylvania in 1790, by Nicholas Allen. This Allen, according to the stories and traditions that have been handed down about him must have been a kind of American Rip Van Winkle. He had come down from the Lake Champlain lumber region, and opened an inn on the summit of the Broad Mountain. For a time he led a wandering existence, hunting, fishing, and lumbering, while his wife attended to the wants of thirsty travelers. In one of his hunting excursions he camped out at the foot of the Broad Mountain, at a spot where a coal vein cropped out, and, upon lighting a fire, was astonished at the intense heat it threw off. He also saw that some of the black stone had become red hot. He dug some of it, and carried it home, when his wife, more practical than himself, pronounced it coal. They saw the coal crop out in abundance, and visions of fortunes that might be realized out of it flashed through their minds simultaneously. So, disposing of their effects, they loaded two large covered wagons with the coal, and set out for Philadelphia, with the intention of marketing it there and discovering its true value. They drove along the banks of the Schuylkill, sleeping in the open air at night. At Pottstown three of their horses died, and the coal was dumped into the river. Wearied and disheartened, the pair returned to the old place at the summit of the mountain, and shortly afterward Allen laid his faithful wife to rest over the coal vein that proved their ruin, and turned his face toward the West, where, after an uneventful career, he enlisted for the campaign under Harrison, and fell at Tippecanoe.

CLOCK MOVEMENT FRAME.

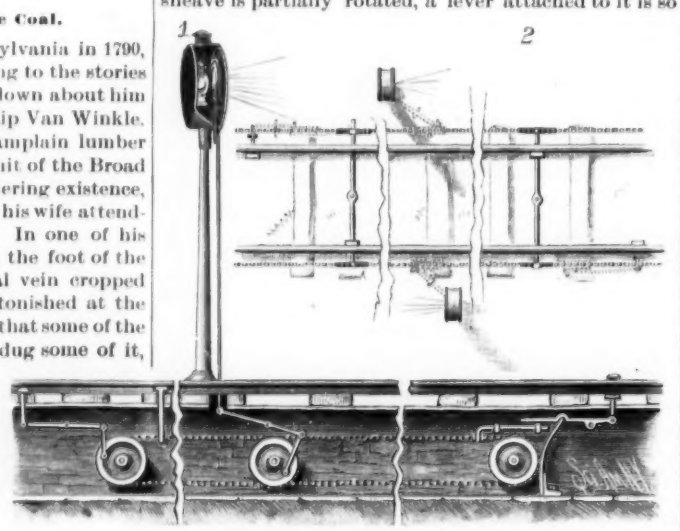
This frame is so made as to permit of removing either of the spring arbors, with their springs, without disturbing the other portion of the movement; or removing all the gearing on either side without disturbing the central portion. The back plate is of the usual description, but the front plate consists of five pieces—a central part and two upper and lower side parts. The latter are provided with apertures for receiving the outer ends of the spring arbors, and are offset so that the portions which overlap the central part and the lateral parts of the upper side pieces may be secured by screws. By removing either of the lower side pieces, the arbor and spring of the time or striking side may be removed without disturbing the other part of the movement. All the gearing upon either side may be removed by taking off the proper side pieces. The front plate may be removed entire after taking off the nuts from the studs secured to the back plate, and removing the pin from the stud passing through the upper end of the center piece.

SANDMARK'S CLOCK MOVEMENT FRAME.

This invention has been patented by Mr. S. P. Sandmark, of Ishpeming, Mich.

AUTOMATIC DANGER SIGNAL.

This invention, which has been patented by Mr. E. E. Phillips, of New Castle, Pa., is more particularly applicable to points upon the track that are not visible from each other, as at curves or tunnels. A train approaching one end of a curve will display a signal at the other end to warn a train moving in the opposite direction. The approaching train strikes the head of a stem carried by a lever pivoted to the wall of a pit extending along the side of the track. This depresses the short arm of the lever and raises the long arm, in which a notch is formed, so as to release a spring strip fixed to a plate upon the bottom of the pit. The spring flies forward to a vertical position, carrying with it a rod fixed to an endless chain whose upper length is thereby moved forward. This movement of the chain imparts a rotary motion to three sheaves, around which it passes. As the center sheave is partially rotated, a lever attached to it is so moved as to draw down a slide and expose the lamp in the signal. The partial rotation of the third sheave, at the opposite end of the line, operates a lever so as to elevate a stem attached to it to a position to be struck by the wheels of the train. When the train reaches this point the stem is depressed, and a motion the reverse of the first is given to all the parts of the apparatus. In other words, the slide will be raised to hide the light, and the bar attached to the chain will be carried back, thereby throwing the spring into engagement with the notch in the first lever, which is thus set so that it may be tripped by the following train. The same system is applied to the other track.



PHILLIPS' AUTOMATIC DANGER SIGNAL.

Trains passing over the section of track protected by the apparatus above described would, in the absence of a proper resetting mechanism, trip the parts, so that as they left the section the signal intended to be displayed by trains passing in the opposite direction would already be displayed. This difficulty is obviated in a simple and effective manner by two transverse levers pivoted to the ties, and which are so connected with the chains that the latter are made to move in opposite direction, so that as the train from the north leaves the section, the mechanism is properly arranged to be operated by the next train from the south. These levers are shown in the plan view, Fig. 2.

IMPROVED LOCK FOR FIREARMS.

The lock herewith illustrated is designed for double barreled guns, although it has but one trigger. The operation of the several elements of the lock for cocking, etc., is the same as in ordinary gun locks, so that a description of these parts is unnecessary. The trigger is arranged midway between two sears (shown enlarged in the detached view), which are put in connection with the trigger by arms which extend from their respective locks to the trigger upon which they lap. It is evident that, on cocking the two locks, they will be operated on by the trigger for firing at the same instant, as the trigger will release the two sears from their respective tumblers simultaneously. On cocking the two locks, the sears and their arms are pushed upward by the tumblers and retained half or wholly cocked by the notches in the tumbler, in the usual way. If only one of the locks is cocked, the pulling of the trigger will discharge but the one barrel, the uncocked lock being inoperative at the time the other is in condition for firing. Both barrels may be simultaneously discharged, or either one singly.

GOODWIN'S IMPROVED LOCK FOR FIREARMS.

This invention has been patented by Mr. Charles E. Goodwin, of Saybrook, Ohio.

Recent Sale of Guinness' Brewery.

The Guinness Brewery, in Dublin, has recently been converted into a stock company. While the colossal size of this business is notorious, few would realize the amount of money that would be put into the stock of the new company. The subscriptions for stock were received by Baring Bros. The scene at their office is described as little short of a riot. Men literally fought to get near the counter. Prospectuses sold freely at half a crown and three shillings apiece. The stock was divided into three classes—ordinary, preferred, and debenture—the premiums on which at this sale ranged from 67 down to 18 per cent. The capitalization had been fixed at £6,000,000. On this sale the market value rose to £8,610,000, or about $40,000,000. The actual value of the stock and fixtures, beer on hand, manufacturing plant, and real estate was estimated at £2,500,000, showing a public estimation of the value of the "good will" at over £6,000,000, or nearly $30,000,000. It is said that over one hundred millions of pounds sterling of capital were offered to Baring Bros. The last statement, however, is pronounced as open to doubt.

Prior Publication.

The question was recently raised in England whether the deposit of a specification in the German language in the library of the Patent Office in such a way as to be accessible to the public was such a publication as to avoid a patent subsequently obtained in England. In addition to the deposit of specifications and drawings at the Patent Office, the fact had been duly announced in the *Patent Journal*. Mr. Justice Chitty, before whom the case came, held that the deposit amounted to a prior publication. The true test, he said, was whether the German specifications had been so published in England as to become matter of common knowledge. The fact that they were not in English, he said, was immaterial, as German was a language generally known.

THE MILLER MANUAL LABOR SCHOOL OF ALBEMARLE, VA.

The traveler journeying west on the Chesapeake and Ohio R.R., after passing through a rather desolate country, begins to note signs of improvement in the scenery. Gradually the pine trees grow fewer, and soon a lovely country appears. Monticello, on the right hand, its eminence crowned by the home of Jefferson, is passed. A few miles more, and Charlottesville, the county seat of Albemarle County, appears. A mile beyond it is the University of Virginia, of which Jefferson and Madison in their day were rectors. On this railroad, and in Albemarle County, is situated Crozet, five and a half miles from which is the Miller Manual Labor School.

It was founded by Samuel Miller, a native of Albemarle County, Va. He was born June 30, 1792. He received a common school education. After a few years passed in teaching, he engaged in mercantile business in Lynchburg, Va., and was so successful that in the course of a long life he accumulated a considerable fortune. His charities and gifts during his life were very great. He was a benefactor of the Lynchburg Orphan Asylum and the University of Virginia. To the latter institution he donated $100,000. But his greatest bequest was devoted to the establishment of a school for poor children of his native county.

On the 1st day of April, 1859, he signed his will, leaving in it a large legacy to be devoted to this end. On March 27, 1867, he died, and was buried in the grounds of the Lynchburg Orphan Asylum, where a monument was erected to the memory of the asylum's friend. Years of lawsuits were devoted to contesting the will, but at last a settlement was reached.

An act was passed by the Virginia Legislature, and approved February 24, 1874, establishing the school, and Mr. N. M. Page, of Batesville, who had been sole executor of the will, then turned over to the Board of Education of Virginia more than one million of dollars to be applied to the school.

Our illustrations show some of the school buildings and interiors, and give an idea of the size and extent of the institution. A main building, that can accommodate 100 students, was first erected, at a cost of $100,000. To this two wings were successively added, increasing the cost by $50,000. Other buildings were gradually erected around this nucleus, additional land was purchased, and machinery bought, until to-day Albemarle County possesses one of the great technical schools of the United States, and one in which the modern feature of manual training holds a most prominent place. The buildings stand in the midst of an estate of nearly one thousand acres, held in fee simple by the trustees.

The object of the school is to afford a thorough education, literary and manual, to orphans and destitute children of Albemarle County. To this seemingly limited scope the trust fund, amounting to $1,276,438.49 in bonds and securities, is devoted. The students are selected by the district school trustees of the different school districts of the county. The course of studies includes a primary, an intermediate, and an academic division, covering seven years. All the ordinary branches are taught to the students, including languages and science. But the manual training is the distinguishing feature.

Every student, before receiving the diploma of the school, has to work for three years in the shops, unless a satisfactory equivalent can be established. At the age of 15 their work begins, if their advancement in general studies is sufficient. The first year is devoted to wood work. Carpentry, turning and carving, the preparation of wood by seasoning, gluing, veneering, the care of woodworking machinery, and the preparation of wood filling, all come in this department. The first branches of woodworking fill the first year's time in the shop. The final work in wood is done later. One of the illustrations, from a photograph of the interior of this shop, shows well how complete is the equipment of the department.

In the second year, iron work and technical drawing are taught. Two views are given of the iron shop. The excellent character of the machines is well shown in them. The instruction proceeds from chipping and filing up through screw machine work, drilling, speed lathe and engine lathe work, to planing and blacksmithing.

Sensibly enough, blacksmithing is named last, as it yields to few mechanical operations in the element of manual skill applicable to it. This course runs into and is prolonged into the third year. The making and tempering of all the tools is included. Steam practice, brass work, finishing work in wood, and technical drawing are also included in the third year.

Steam is supplied by four forty horse power boilers. The boiler house adjoins the work shop. There the practice in steam working is acquired. The two buildings are shown in the cut. A 25 horse power Corliss engine, built by Harris, shown also among our illustrations, is used to drive the machinery. An Edison 400 light electric plant supplies light for the buildings.

Besides the branches described, others are included. Printing and telegraphy are taught as practically as are the other branches. The catalogue of the school is printed by the students, and is a most creditable specimen of typography. Surveying, electrical and civil engineering, agriculture, and horticulture also come within the curriculum. The agricultural department, it is hoped, will soon be as well equipped as the mechanical one.

The steam laundry, a building in which some of the features of the Old Dominion architecture can be traced, is also shown among the illustrations. The chapel is seen in the center of the page, a plain yet impressive room. Here services by clergymen of different denominations are delivered, the denomination changing from Sunday to Sunday. Music and congregational singing are elements. A library opened daily for the drawing out of books is also provided.

Every second week, evening entertainments are held in the parlor, in which pupils and officers of the school with their families participate. These give a home atmosphere to the place, and tend to create a feeling of friendship between teacher and pupil.

Recently a girls' school has been started, but is separated from the male division. Manual training is a part of the course in it also.

The growth of this school, with its extraordinary endowment, one of the largest in the United States, has been rapid. It started with thirty-three students on the roll in the term of 1878-79. Now, in addition to the pupils in the girls' department, still limited in numbers, some two hundred students are in attendance.

The restrictions as to the appointing of students seem almost a subject of regret. Albemarle County has not a single large city in it; its entire population (32,618, census of 1880) is about half that of New Haven. Yet the benefits of an endowment large enough to be the basis for one of the great schools of the world are confined to this small region.

By it Virginia is awarded the distinction of being a leader in the educational field. In view of this great bequest, added to his other gifts, Samuel Miller is justly named Virginia's greatest benefactor.

What a Western Farmer Saw in the East.

A Western farmer, who lately took a trip East, writes as follows to the *Country Gentleman:*

The first thing to impress me when going from the West to the East is the economy of land in the East. In the West, and even in Illinois, we give everything an abundance of space in which to grow. We often have, for example, the space of a rod between the crop and the fence. If the crop wants to spread itself, we propose to gratify it without straining the fence. The great fertility of our Western land may make this necessary, you know. Our orchard trees are planted wide apart. East they seem to be crowded against the buildings or against the fences. Many more ornamental trees have been planted in Illinois than in New York. Is this because land is so valuable in New York, or because our bare prairies make us love trees the more? But we might well learn of our Eastern brethren in the economy of land.

In one way, however, the Eastern farmers are wasteful of land: they make the fences as crooked as the ways of a politician—to suit some slight conformation of the ground, to avoid passing over a small brook, or what in some cases appeared to me could be only a desire to make the fence as crooked as possible. Now, geometry demonstrates that "a straight line is the shortest distance between two points." It would economize both fence and land to make the fences straight; and the fields would be easier of cultivation. Cross fences, at least, could be straightened. Where the boundaries of farms are crooked lines, why not cut off a rod here and a rod there, and make the boundary line straight? For that matter, while we are speaking of economy in fencing, why not have no fences, as in the West? The old common law was right; a man should fence his own stock in, and not all the world's out; and if this should now prevail, one-fifth of the fencing we now have would answer, and we would not at all be inconvenienced, either.

Shall I offend the pride of my Eastern readers if I say that Illinois has better farm dwellings than New York or Pennsylvania? It is true. Compare the best parts of the States, and we can beat you on houses. But you Easterners beat us on barns; and you beat us further than we beat you on houses. In barns and all outbuildings, you are far ahead of Illinois—of course, further ahead of Nebraska or Kansas. I like to look at the barns in the best part of New York or Pennsylvania, they are so large and substantial and neat. I believe the barns are neater and better kept than the dwellings. Not long since I visited an Illinois farmer who had his own waterworks and gasworks, having water and gas in all parts of his large and very handsome four-story brick and stone dwelling. His barns were large; but they were of boards, had never known paint, and there was litter and manure about them. I could not help but contrast them with the neat Eastern barns, in which I could see the cattle eating. Think of us, or a Nebraskan or a Kansan, putting cattle in a stable in summer! It would pay a Western farmer for the trip to go East and study only barns and stables. He would then realize how much feed he wastes, how much he loses by exposing his animals, and how much manure he might get on his land.

In the West much more farm machinery is used than in the East. It causes a Westerner to laugh to see small grain being cut with a "dropper" or a self-raking reaper; and he cannot refrain from laughing heartily when he sees grain being cut with a cradle. I do not think that one Nebraskan in a thousand would cut grain with a cradle; he would lose the grain first. Nothing short of a self-binder will answer; and then we put on five horses, and cut and bind twenty acres a day. Six years ago I cut 147 acres in one week, and didn't work in the dark or on Sunday either. True, I used ten horses, two sets of five, but that was because the ground was so soft I would mire down if I didn't drive fast, and several times did it anyhow.

We don't cover corn with a hoe. We plant from twenty to thirty acres a day with a self-dropping two-horse planter. We raise the hay on the wagon with horse power (but pile the hay out of doors, sad to say); ride when we plow or harrow, or plant or sow, or reap or bind; and thrash by steam. In great part this is because of our smooth, level land, free from stones and stumps—but in part because we are more enterprising. (Fact.) The Eastern farmers are more wedded to old ways. They look at a dollar longer before they spend it for some improvement, and likely put it back in their pocket when they have finished looking at it. Take the matter of tile draining, for illustration. When Ohio farmers found that it paid to tile-drain, they put down tile liberally. Now the craze has struck Illinois, and Illinois farmers are planting tile as they would corn.

We have found it cheaper to make the wind pump our water than to do it ourselves; and the wind is doing a big lot of work of that sort. Get across the Missouri River, and a well without a wind pump above it is a curiosity. The wind kicks over the traces sometimes, and distributes houses and cattle around in a very annoying manner; but generally it works well and boards itself. My Eastern readers may claim all the credit for Western enterprise by saying that Westerners are emigrants, or descendants of emigrants, from the East. This is about true. The man that pulls up stakes in the East and goes out to Kansas or Nebraska must have considerable enterprise and go-aheaditiveness. And this does more than crop out in his new home—it expands.

I find that a great many Eastern people fancy that we raise mostly scrub cattle in the West. A trip West would change their notion. One of the surprises to me when I made my Eastern trip was that the cattle in New York were no better than the cattle in Illinois. I expected to find them better. Taken as a whole, New York has better dairy cattle than we, though Illinois has as good dairy cattle as any. In beef cattle we are ahead of the East—further ahead than they are of us in dairy cattle. In the West the cattle are not quite so good as in this middle territory; but there the scarcity of cattle is more apparent than the poor quality. And this is true of all stock. Even the ranchmen are now using full-blood males, some ranch owners buying Hereford, or Short-Horn, or Polled-Angus bulls by the hundred. You care for your farm animals far better East than the Westerners do—better than we do. This is not because of our ignorance or cruelty, but because many in the central part, and nearly all in the West, are paying for their land yet, and good barns and stables will come as soon as we can get to them. But observation, and especially conversation with those farmers who get on the trains, convinces me that raising scrubs can be set down against the East rather than against the middle section, or even the West.

We farmers should travel more. The Westerner can learn much of the Easterner, and the Easterner can learn just as much of the Westerner. The Westerner will be impressed that the *forte* of the Easterner is to save; the Easterner will think that the *forte* of the Westerner is to make. If the enterprise of the one could be combined with the economy of the other, both would be richer. If the Westerner goes East expecting to find every farmer highly intelligent, as I did, he will be fooled. If the Easterner goes West expecting to find every person ignorant, he will be worse fooled. No State in the Union can show more college graduates to the square inch than Kansas. There is more planting in the moon in the East than in the West, and more coins put away in socks; but in the West we are apt to spread our planting over eighty acres of earth when it should be only forty, and to buy land when we have nothing in our socks but holes. JOHN M. STAHL.

Quincy, Ill.

IN Rochester, N. Y., on the 20th of November, 750 out of the 950 customers of the Bell telephone declined to use the instruments any longer, on account of the exorbitant charges; and they are now casting about for instruments that be supplied at cheaper rates. Here is a good opening for the House telephone, in which is found the "undulatory current" of the Bell system. The original patent of House has expired, and is free to the public.

IMPROVED WHEEL BORING AND FACING MACHINE.

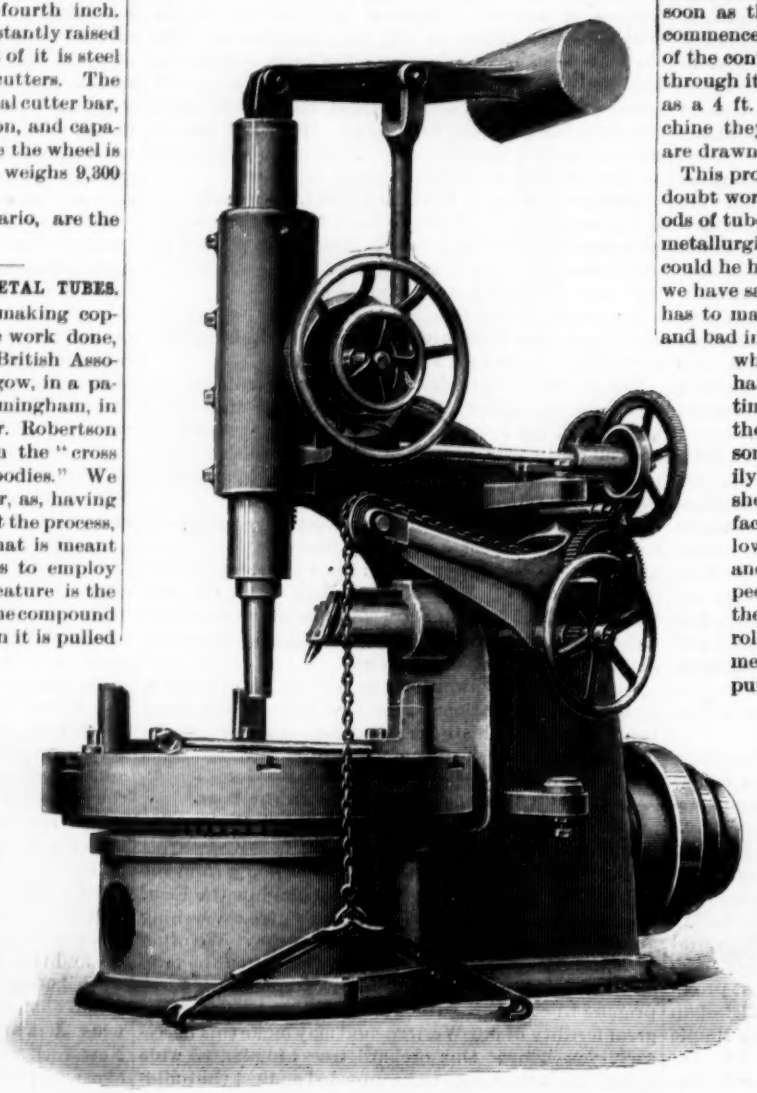
The illustration represents a 42 inch, very powerful car-wheel boring machine. It is provided with a light lifting tackle, to raise the wheel and place it in the horizontal chuck, which revolves in the bed piece. The boring bar stands vertically over the center of the chuck, and has a cast steel rack, to which the feed is imparted by a worm motion with a friction clutch, the cut varying from one-tenth inch to one-fourth inch. The bar is counterweighted, and can be instantly raised and lowered with little effort. The point of it is steel fitted in a taper socket for carrying the cutters. The hubs of the wheels are faced by a horizontal cutter bar, provided with an independent feed motion, and capable of being run close to the framing while the wheel is being placed in the chuck. The machine weighs 9,300 pounds.

McKechnie & Bertram, of Dundas, Ontario, are the makers.—*Engineering.*

A NEW SYSTEM OF MANUFACTURING METAL TUBES.

An account of a remarkable system of making copper tubes, illustrated by specimens of the work done, was given at the recent meeting of the British Association, by Mr. James Robertson, of Glasgow, in a paper read by Mr. Ralph Heaton, of Birmingham, in whose works the system is adopted. Mr. Robertson calls the principle involved in his system the "cross surface motion frictional contact of solid bodies." We need not reproduce Mr. Robertson's paper, as, having seen the machinery at work in carrying out the process, we may, perhaps, describe more briefly what is meant by the above, and then leave our readers to employ their own nomenclature. The essential feature is the application to tube-drawing mandrels of the compound motion which any one gives to a cork when it is pulled out by a slightly twisting movement, or of the partial rotative movement given to, say, a wheel when it is being pushed on to a shaft upon which it fits tightly. The same principle had previously been employed by Mr. Robertson as a means of making pistons and piston and slide rods move more freely than when the pull or push imparted to them caused them to move only in the direction of their axes, and not to rotate upon them. The same principle has recently been employed by Mr. Wicksteed for the rotating pistons in his autographic testing apparatus.

The difference between the force necessary to slide a gland along a rod when the rod is fixed and when it is rotated at a hundred or so revolutions per minute has been found by Mr. Robertson to be something like sixty times, and the force necessary to pull a bulb-ended mandrel through a tube is said to be from sixty to eighty times more when pulled in the ordinary way than when rotated at the same time that it is pulled. According to Mr. Robertson, the greatest saving of power seems to be effected when the movement in a rotative sense of the surface concerned is about equal to its linear axial advance. The rotating mandrel has been adopted for drawing welded tubes, and it is found that by rotation the mandrel is at the same time prevented from heating to any material extent, and that a tube which previously required two heats can now be made in one. This causes a saving in mandrels, and we are informed that the higher the speed the less the heating of the mandrel for given work, and a mandrel of proper form, if rotated at about 4,500 turns per minute, may be made direct into thick "shells" for large or small tubes. The ingots are from 4 in. to 7 in. diameter, and by means of a small mandrel a hole may be, and often has been, forced into one of these smaller sizes; but by making a small hole through in the first instance in a special machine, the mandrel enlarging the hole from say 1 in. to 3·5 in., may be pushed through the ingot at the rate of from 6 in. to 9 in. per minute, and even a foot per minute, a current of oil being maintained through the hole and the mandrel rotated at about 20 revolutions per minute and pushed with a pressure of about 50 tons.



IMPROVED WHEEL BORING AND FACING MACHINE.

The engravings below, Figs. 1, 2, 3, 4, 5, show a machine for the purpose of converting ingots into "shells," and Figs. 6 and 7 show enlarged views of the ends of the mandrel; Fig. 6 being as used up to about 4·5 in., and Fig. 7 as used for sizes up to 6 in. and 7 in. These mandrels are rotated in the opposite direction to that which would be necessary if they were reamers. They are made of steel, and for the larger sizes ordinary Bessemer steel is found to be the best adapted for the work and to stand the hardening. Reference to the engravings will show the mandrel at C carried by the spindle, D, and rotated by the wheel, F, driven by a pinion, G, which slides on the shaft, H. The mandrel is forced forward by the plunger, J, which is pressed by water forced into the cylinder containing it by special pumps, no system of step bearing being sufficient for the purpose, although everything was tried before the water bearing for the plunger was adopted. The plunger revolves, and is brought back to the small plunger, K, head, L, and wheel and chain gear seen in Figs. 2 and 4. The ingot, B, is held in the containing shells, A, by the gripping pieces, S S, the container holder being a very powerful casting, A A, in which the inclined surfaces of the two halves of the container fixed themselves and the ingot, as seen in the plan. As soon as the ingot is operated upon by the mandrel it commences to elongate, and a 2 ft. ingot will come out of the container after it has had a 3·5 mandrel forced through it, there previously being only a 1·25 in. hole, as a 4 ft. shell. When the shells come from this machine they pass to tube-drawing rolls, in which they are drawn out upon a rotating mandrel.

This process is in course of development, and will no doubt work some great changes in the present methods of tube making. It is exceedingly interesting as a metallurgical process, and would have delighted Tresca could he have seen it. As may be expected from what we have said as to the rate at which the copper ingot has to make up its mind to change its form, a hard and bad ingot will not stand the first process, but those which do stand it—and they are nearly all—have thereafter a comparatively comfortable time in the succeeding drawings which follow the annealing after the first. The surface sometimes shows that the ingot has been heavily dealt with, but a light cut is run over the shells in a lathe at a high speed, and this surface defect, when it exists, is removed at very low cost, and the result is that splendidly sound and strong copper tubes are the result, especially adapted, owing to the way in which the metal is compressed, for calico printing rolls, as well as for the purposes of large and medium size copper pipes for general steam purposes.—*The Engineer.*

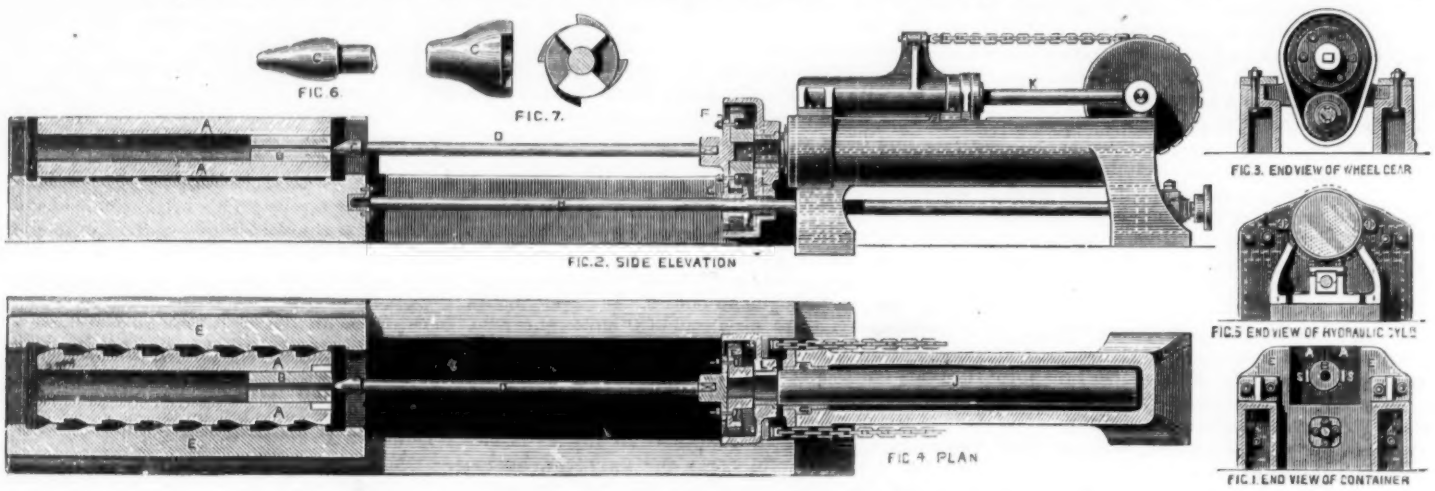


FIG. 6.
FIG. 7.
FIG. 2. SIDE ELEVATION
FIG. 4 PLAN
FIG. 3. END VIEW OF WHEEL GEAR
FIG. 5 END VIEW OF HYDRAULIC CYLS
FIG. 1 END VIEW OF CONTAINER

NEW MACHINERY FOR MANUFACTURING METAL TUBES.

An International Telephone Exhibition.

The Belgian Society of Industry and Engineering will open an international exposition on Jan. 9, 1887, at the Palais de la Bourse at Brussels. The design is to have as complete an exhibition as possible of all the apparatus for transmitting articulate speech, and to show what progress has been made since the first conception of the telephone. The exposition will comprise telephones, microphones, radiophones, phonographs, also the applications to which these may be put, central telephone systems, telephone stations, etc., conductors, and methods of insulation.

All the new inventions in this particular line will be shown by means of models, apparatus, plans, or diagrams.

A complete library on the subject of telephones will be connected with the exposition. The exhibition will last for five weeks, and those intending to enter should give notice to the directors through the secretary, Mons. Ch. Legrand, Brussels, before December 1.

A Ton of Coal.

There is more in a heap of coal than most persons are aware of. Besides gas, a ton of gas coal will yield 1,500 pounds of coke, 20 gallons of ammonia water, and 140 pounds of coal tar. Destructive distillation of the coal tar gives 69·6 pounds of pitch, 17 pounds of creosote, 14 pounds of heavy oils, 9·5 pounds naphtha yellow, 6·3 pounds of naphthaline, 4·75 pounds of naphthol, 2·25 pounds of alizarine, 2·4 pounds of solvent naphtha, 1·5 pounds of phenol, 1·2 pounds of aurine, 1·1 pounds of aniline, 0·77 pound of toludine, 0·46 pound of anthracine, and 0·9 pound of toluene. From the last named substance is obtained the new product known as saccharine, which is said to be 230 times as sweet as the best cane sugar.—*Iron.*

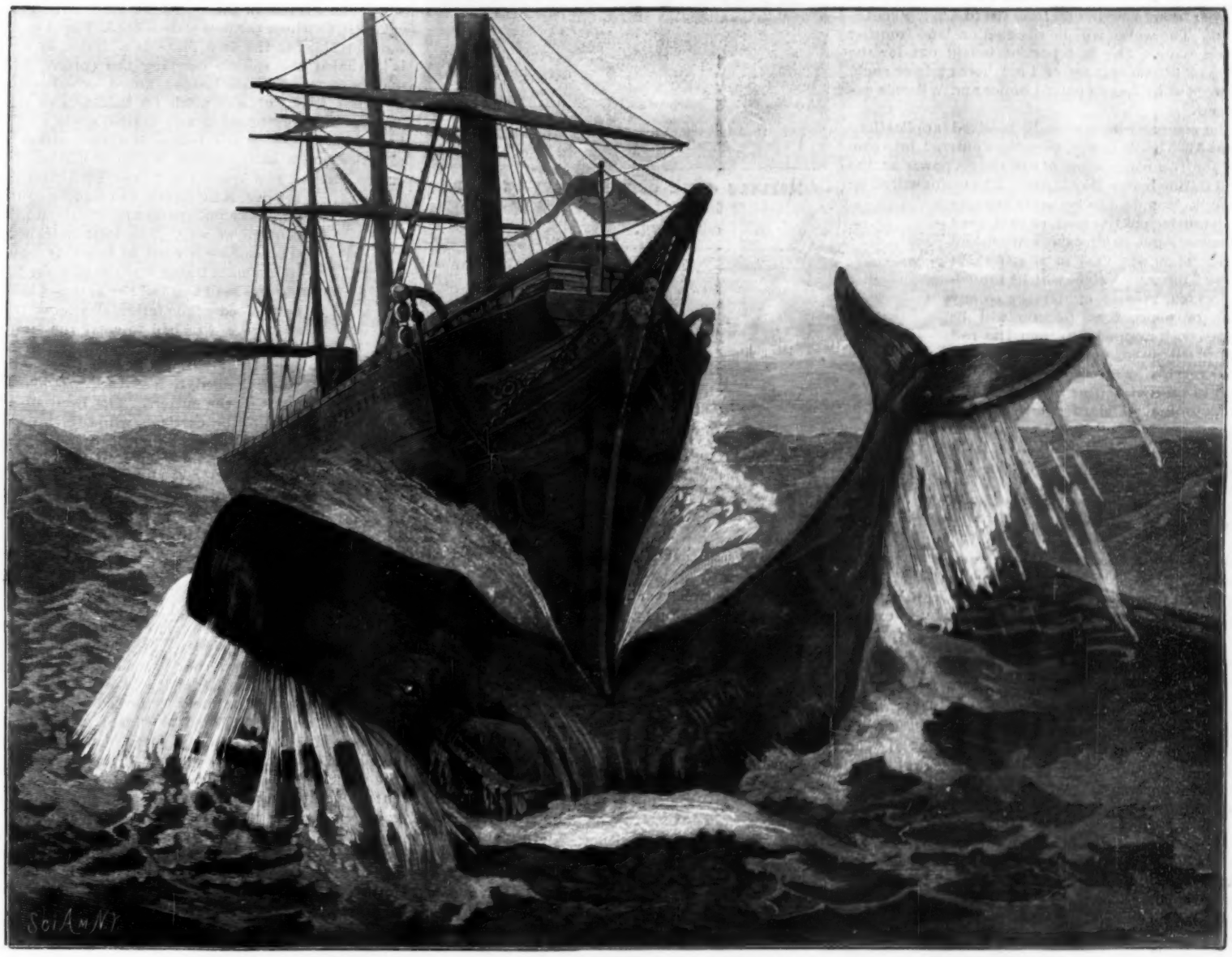
COLLISION BETWEEN THE NETHERLAND STEAMER WAESLAND AND A LARGE WHALE.

The Netherland steamer Waesland, 3,500 tons, which left Antwerp on the 11th of July last, and arrived in New York July 27, reported that at noon on the second day a whale was seen floating on the water directly in the vessel's course.

No attempt was made to avoid the animal, as the natural impression was that it would get out of the way of its own accord. It declined to move, however, being fast asleep most likely, and the steamer's sharp iron bows struck full and fair about midway of its length.

There was a perceptible shock to the vessel and an immediate checking of her progress. Passengers and deckhands ran forward to see what was the cause of the trouble, and found that the whale was fully 80 feet long, had been cut half way in two, and lay dead and fast, caught on the bows.

It was necessary to stop the ship and back off to disengage the carcass, which, when freed, drifted astern.



COLLISION BETWEEN THE NETHERLAND STEAMER WAESLAND AND A LARGE WHALE.

None of the officers of the ship had ever witnessed a similar occurrence, although it is by no means an unheard of one. Ships have struck sleeping whales before, and on several occasions have suffered damage from the collision.

A New Mode of Tanning by Means of Pyrofuxin, a New Tanning Material from Bituminous Coal.

Pyrofuxin, a new substance contained in nearly all pit and bituminous coals, discovered and brought forward by Professor Paulus F. Reinsch, of Erlangen, Bavaria, seems, without doubt, to be one of the most powerful, effective antiseptics, that is, preventives of fermentation, of which we have knowledge.

In its antiseptic power lies the extremely intense and rapid tanning property of pyrofuxin, an effect which renders it useful in the production of leather. On the contact of pyrofuxin with those skin and muscular tissues which undergo decomposition, pyrofuxin combines with them with such an intensity that, after lying a long time in water, neither decomposition nor extraction of the pyrofuxin results.

In a dry condition, pyrofuxin is a fine, non-triturable substance, without taste or smell, insoluble in water, not poisonous, and in appearance like catechu. In caustic ammonium potash or soda solutions, wet pyrofuxin is very soluble, and forms a deep dark brown homogeneous liquid; on exposure to the air, that is, to the action of carbonic acid gas, the pyrofuxin is not precipitated, but remains in solution. The patented preparation of pyrofuxin is made as follows: Pit or bituminous coal, which contains at least 5 to 10 per cent of pyrofuxin, is broken up into lumps of the size of nut coal. By repeated boiling in a solution of caustic soda, the pyrofuxin is extracted. The solution of pyrofuxin, still impure, is allowed to stand for a time. The solution is then poured off, and all remaining alkali is removed from the combination by passing through the solution carbonic acid gas. The liquid thus obtained has a specific gravity of 1·025 to 1·030, and holds in one liter ten to fifteen grammes of pyrofuxin in solution. Only a very few kinds of mineral coal yield pyrofuxin, but where it does occur the coals are abundant. The best raw material is the leaf or paper coal of central Russia, with a yield of 18 per cent, and also several bituminous coals in central Europe.

After the extraction of the pyrofuxin, the coal remains combustible, and may be used as fuel.

The intense action of the pyrofuxin shortens the process of tanning leather very considerably.

Taking the time of tanning with pyrofuxion as 1, alum requires 14, tannic acid 28. That is, for alum tanning, 14 times as many days are required as for pyrofuxin; for tannic acid or bark tanning, 28 times as many days are required as for pyrofuxin tanning.

Under the microscope, the structure of pyrofuxin tanned leather is seen to differ very essentially from alum or bark tanned leather. The felt structure of the corium is finer in fiber, more closely interwoven, but with a sharper definition of the fibers. The epidermis is harder, and yet more elastic. From this peculiarity of structure in the leather tanned by pyrofuxin, it is readily seen that a most excellent article is produced, while the epidermis is harder than in alum and bark tanned leather. Still it is not brittle. Furthermore, raw material of comparatively low value, as sheepskin, for example, is changed by pyrofuxin tanning into a product much better and more valuable than by the processes with alum or bark. Pyrofuxin sheepskin has been already practically used, and has stood the test as upper leather, both in the making and the wearing.

The absolute firmness of leather, in other words, the maximum stability of the fibers after the application of certain weights, is a gauge of the quality of leather. Experiments were made in placing weights on equal sized bands of leather tanned by alum, tannic acid, and pyrofuxin, and taken from like parts of the hides. These hides were also alike in the raw state. The following results were yielded: For pyrofuxin sheepskin, twice to three and one-half times the maximum weighting of bark tanned sheepskin, and four to five times the maximum weighting of alum tanned sheepskin. Since the discovery of this tanning material, two processes, differing from those customary in tanning leather, have been found out, which can be used in the production of all very durable leathers, and practical application will no doubt modify even these procedures.

Tanning by pyrofuxin is simple, and needs no new appliances.

As compared with bark tanning, the cost of tanning material is lowered about 25 per cent. The marked saving of time in the production of a really excellent article assures for this new tanning material and the new ways of tanning a bright future. The present wide extension of the tanning industry increases markedly the demand for tanning material, and from year to year new tanning stuffs are placed in the market, which in reality are simply new editions of old works, and only differ relatively in price and effect.

A tanning material absolutely new and also valuable will of course bring with it new ways of doing. If he would not be left behind, the tanner must make use of the advance of technical chemistry, and employ a tanning stuff which, without transplanting the old stuff, still offers greater advantages.—*Frankfurt on the Main Ledermarkt.*

[The foregoing account of the great efficiency of an alleged new tanning material is somewhat similar in its tone to others that we have met with in German technical journals during several years past, from any one of which it might have been inferred that German tanners were making substantial advances on old-time methods of producing leather. We have no other practical evidence, however, that such is the case, about the only great improvements in leather making for a long period, according to general acknowledgment, having been in the line of mechanical appliances for saving time and labor, in which this country has conspicuously held the foremost position. The field of chemical investigation in regard to tanning is one which American inventors and experimenters seem to pay little attention to.—ED.]

Progress of the Birmingham Compressed Air Power Scheme.

Mr. J. Sturgeon, the author, pointed out that, although each 1,000 horse power at the central station may only produce 500 effective horse power at the users' engines, it will displace fully 1,000 horse power of small boiler plant, furnaces, chimneys, etc., and the same engines can be used with compressed air as with steam. The centralization principle enables engines and boilers to be used of large power, with all the modern improvements, such as high pressure, triple expansion, gas firing, etc. At the pressure proposed (45 lb.), the air-driven engines will indicate from 30 to 65 per cent of the power developed at the main engines, according to the mode of using the compressed air.

According to the investigations of Sir F. Bramwell and Mr. Piercy, on behalf of the Birmingham corporation, the present consumption of fuel in small engines of from 4 to 25 horse power varies from 36 lb. to 8½ lb. per horse power per hour; and as it is estimated that compressed air power would reach the consumer at an expenditure of from 5 lb. to 2 3 lb. fuel per horse power per hour, a saving of from 700 to 400 per cent is effected. The works will be situated on land fronting Garrison Lane. The first portion is laid out for the erection of fifteen engines of 1,000 horse power each, to be worked by Lane's patent boiler and Wilson's gas producers.

As the company have already received applications for over 3,300 horse power, they have entered into contracts for the completion of 6,000 horse power at the central station before May 31, 1887. The mains will all be of wrought iron, laid in concrete troughs near the surface of the road, so that they can be easily got at for examination and repairs. They will vary in size from 24 down to 7 inches. Valves will be provided, by which, in case of damage to any portion of main, that portion will be automatically stopped off from the rest of the district, so as not to interrupt the general service. The compressed air will be sold to users at a price per 1,000 cubic feet of air of a standard pressure of 45 lb., measured by a meter so constructed as to register the volume delivered at the value of the standard pressure, independently of any variations there may be in the main pressure. The meter consumption of the various users will be registered in the gross on a dial at the central works by electric apparatus, so that any waste or misuse of the air can be at once discovered and prevented. Compressed air can be used for all purposes for which steam is employed, except heating. Air, on the other hand, has the advantage over steam that it is available for refrigeration.

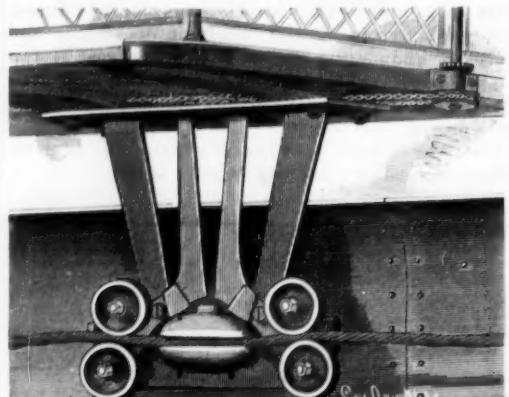
How to Make Phosphorescent Materials.

The sulphate of calcium, which is remarkable for its violet phosphorescence, and forms the basis of some luminous materials, has been analyzed by M. A. Verneuil, who finds it to contain monosulphide of calcium 37 per cent, lime 50 per cent, sulphate of lime 7 per cent, carbonate of lime 5 per cent, with traces of silica, magnesia, phosphates, and alkalies. He also finds that it is a *coquille* shell which furnishes the lime used. M. E. Becquerel has made extensive researches on these luminous powders, and M. Verneuil has more recently followed up the subject. He gives the following process for preparing what he considers the most beautifully phosphorescent matter known. Twenty grammes of lime from the *Hypopus vulgaris* shell, calcined, is pulverized and intimately mixed with six grammes of sulphur and two grammes of starch. To this mixture is added drop by drop a solution containing half a gramme of subnitrate of bismuth, 100 cubic centimeters of absolute alcohol, and some drops of chlorhydric acid. When the most of the alcohol is evaporated by exposure to the air for half an hour, the mixture is heated in a covered crucible for twenty minutes to a clear cherry heat. This temperature is obtained easily by wood charcoal or a Perrot gas furnace. After pulverizing the mass, it is again calcined at the same temperature for a quarter of an hour. If not too strongly heated, the product obtained is small grained, lightly agglomerated, and easily crumbled. A new pulverization is to be avoided, as it tends to diminish the phosphorescence. The addition of sulphides of antimony, cadmium, mercury, tin, copper, platinum, cranium, zinc, molybdenum, produces a variation in the color of the light, which varies from yellow green to blue green. Manganese produces an orange tinge. Sulphides of cobalt, nickel, iron, and silver diminish the phosphorescence.

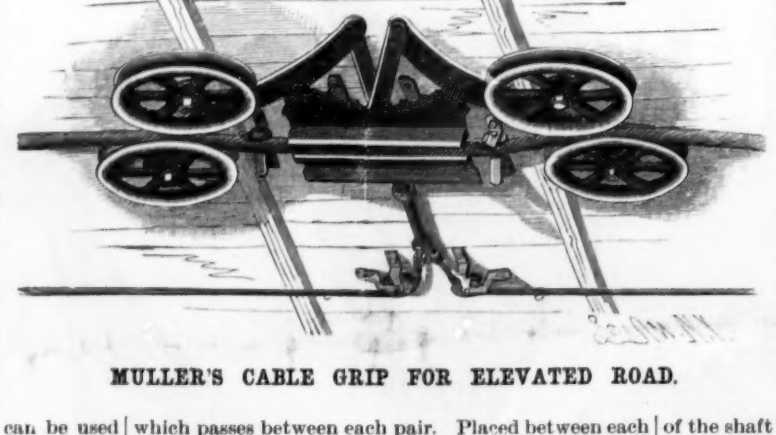
THE first use of a locomotive in this country was in 1829.

IMPROVED AUTOMATIC CABLE GRIP.

This grip consists essentially of two levers pivoted so as to form short and long arms. Upon the end of each short arm is loosely mounted a grooved pulley, and to the ends of the long arms are attached ropes or chains that pass around a sprocket wheel on the lower end of a vertical shaft located on the end platform of the car. This shaft is provided with the usual hand wheel, by means of which the levers may be operated. Placed opposite, but not in a direct line, to the movable pulleys are two others, similar in every respect, except that they have no movement toward or from the cable which passes between each pair. Placed between each set of pulleys is a gripping jaw, formed of one immovable and one movable plate, both of which are longitudinally grooved along their facing edges to receive the cable. The movable jaw is operated by the two levers, but it is not moved sufficiently far to secure a grip until after the pulleys have firmly taken hold.



MULLER'S CABLE GRIP FOR SURFACE ROAD.



MULLER'S CABLE GRIP FOR ELEVATED ROAD.

It will be seen from this construction, the extreme simplicity of which is apparent, that when the pulleys first come in contact with the moving cable, they will turn on their spindles until the pressure exerted by the levers is enough to clamp the cable, which will then carry the car along with it. The further movement of the levers causes the jaw to firmly grip the cable. There are thus two separate holding forces brought to bear upon the cable—the first a rolling contact between the rope and pulleys, and the second a direct grip of the jaws. It will also be seen that when the gripping jaw is released, the pulleys will grip the cable sufficiently, allowing the car to travel at a less speed than that of the cable, at the will of the gripman, which at times is necessary in a crowded thoroughfare, to avoid accidents. This combination prevents any excessive wear on the cable, and at the same time forms a reliable and easily operated grip. When the grip is open, the lower pulleys are so placed that they will also act to support the cable. The pulleys are not subjected to great continuous strain, since they merely serve to start the car, the jaw then sustaining all the strain. The holding power of each pair of pulleys is practically augmented by reason of their being placed at such an angle with the cable as to slightly bend it. One of the engravings shows the grip arranged upon a vertical frame, secured to the bottom of a car, and passing through the slot in the ordinary trench, while the other shows the grip placed horizontally and attached directly to the car bottom.

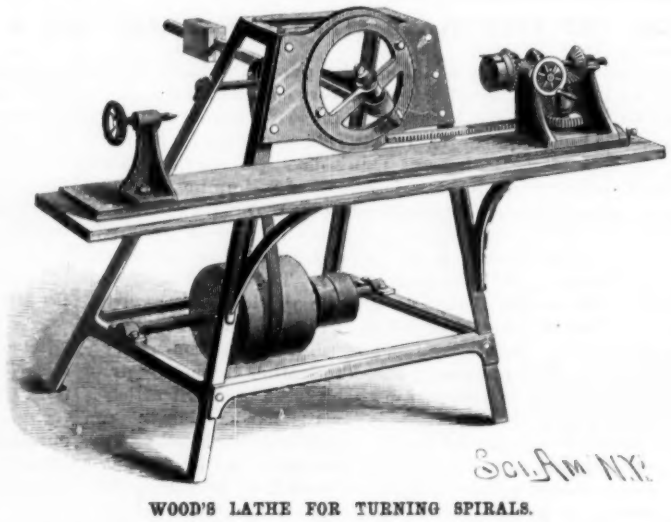
Further particulars regarding this invention can be obtained from the patentee, Mr. George Muller, of Hoboken, N. J.

LATHE FOR TURNING SPIRALS.

This machine is adapted for cutting spiral twist mouldings or forms on the exterior surfaces of turned work, such as stair balusters, newel posts, and the like, whether it be cylindrical, or tapering, or curved, and irrespective of the diameter or length of the work. The frame of the machine is made with a vertical front, to which the face plate is fixed. Fitted snugly, but movably, to the face plate is a frame, in which is journaled the spindle carrying the cutters, which may be formed to work beaded, fluted, or other forms in spiral twists of any pitch on balusters or posts. The spindle may be set at any desired angle with the horizon by turning the frame, but the cutters will always operate at the center or axis of motion of the cutter frame. The spindle is driven by a belt passing over a tightener, and leading to tight and loose pulleys on a shaft driven in any convenient way. The main workbed of the machine is fixed to brackets secured to the main frame, and the carriage holding the head and tail stocks is laid loosely on the bed. The tail stock may be freely swung on the bed to carry the work to and from the cutters, and, at the same time, the carriage is free to be moved along the bed, to feed the work along in front of the cutters. The head stock is fixed to the carriage, while the tail stock is adjustable along the carriage to accommodate the length of the work. In the head stock is journaled a live spindle, which holds one end of the work. On the inner end of a shaft journaled at right angles to the spindle is fixed a beveled pinion, which meshes with a gear fixed to the head block. At the outer end of the shaft is a hand wheel, by turning which, motion is imparted to the spindle and its connected parts.

On the spindle are placed two beveled pinions, either of which may be engaged by a gear fixed to a vertical shaft journaled to a cross bar of the head stock, and to the lower end of this shaft is fixed a gear wheel, which engages with a rack bar held to the bed in such a manner that it may be adapted to engage gear wheels of different sizes, to govern the speed of rotation of the spindle and work, in accordance with the diameter of the work and the pitch of the spiral mouldings to be cut. Operating the hand wheel with the right hand causes the work to be turned and the carriage to be moved forward, while the left hand is free to press the work to the centers by pushing the carriage inward.

After the first spiral cut has been made in the work, from the head stock toward the tail stock, the carriage is swung backward to carry the work away from the cutters, when a dividing wheel on the spindle is turned around a distance of one or more notches and held by a latch. The work is then fed along the cutters for making the second spiral; this is repeated as many times as may be necessary to go around the work. It will be seen that spirals may be cut upon tapering work for the whole or any part of its length, and upon cylindrical or curved work. By properly arranging the cutter spindle and turning the hand wheel in the reverse direction, left hand mouldings may be cut.



WOOD'S LATHE FOR TURNING SPIRALS.

This invention has been patented by Mr. George Wood, of 4724 Main Street, Germantown, Philadelphia, Pa. Further particulars may be obtained from the inventor or from Mr. William Hacker, of 170 Wistar Street, same place.

Government Payments for Oil.

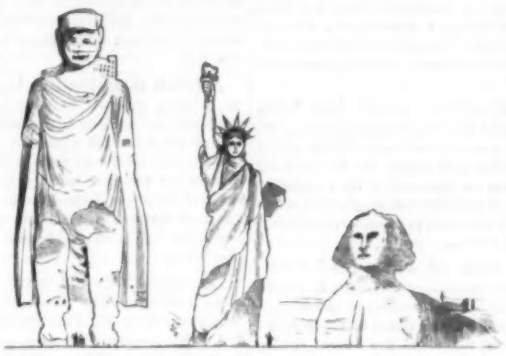
The Treasury Department has awarded contracts for supplying oil for the use of the lighthouse service as follows: For mineral oil, to the New York Refining Company, at 6 35-100 cents per gallon; for lard oil, to be delivered at the depot on Staten Island, to Armour & Co., of Chicago, at 50 cents per gallon; for lard oil, to be delivered at San Francisco, to Yates & Co., of San Francisco, at 54 cents per gallon. These prices are much lower than formerly paid.

THE COLOSSAL STATUES OF BAMIAN.

The existence of the great statues of Bamian has been long known to Indian archæologists, but correct drawings of them, or reliable measurements, have never been brought home till now. At last they have been drawn and measured in a manner that can be depended upon; this is one of the many important results of the Afghan Boundary Commission. Officers of the Survey Department accompanied the Commission, and they have been busy at work all the time; the outcome of this will be reliable maps of the region. To carry out this, the survey officers have gone off on excursions in various directions; last November, Captain the Hon. M. G. Talbot, R.E., started, along with Captain Maitland, of the Political Department, on a survey route through the Koh-i-baba, or Paropamisus range. They went eastward along the Heri-Rud valley, from near Obeh, till they reached Bamian, a line of travel over which almost no European had before passed. Ferrier may perhaps have gone over a small portion of it at the western end. It is to Captain Maitland that we are indebted for the sketches of these great statues, as well as the remains of paintings on the walls of the niches and caves.

Bamian is on the road between Cabul and Balkh, where it crosses the Paropamisus range. The situation is high, being somewhere about 8,500 ft. above the sea. The rock is conglomerate, or pudding stone, of which there is a high cliff in the valley. In this, at an early period, probably during the first centuries of the Christian era, Buddhist monks excavated caves. These are in large numbers at Bamian—"extending for miles"—but there are numerous groups of caves besides, extending northward, along the road as far as Haibak. Judging by the remains in the Jelalabad valley, these caves would not be the only viharas or monasteries; there would be built structures as well. When Hwen-Tsang, the Chinese pilgrim, visited Bamian, about 630 A.D., he states that there were 1,000 monks at it, and ten convents. He describes Bamian as a kingdom; but now we only know the spot from its caves and the great statues, which are remains of Buddhism, and not, so far as is known, the remains of anything like a capital city of a kingdom. There stand near to this spot the ruins of an old city, known as Ghulghula, which was utterly destroyed by Genghis Khan, in the thirteenth century. He gave the order that not a soul was to be spared—man, woman, or child—all were to be slaughtered; the order was fulfilled, and the place has been a ruin ever since. Ghulghula may have been the principal city, of which Bamian was only a sort of suburb. This is confirmed by the Chinese pilgrim, who states that the statues were on "the northeast of the royal city." Alexander, in passing from Bactria to India, crossed the Paropamisus range either at Bamian or near to it; but the historians who describe his doings give no mention of the statues. This is, so far, evidence as to their non-existence at the time. It is also understood, as confirmation of this, that Buddhism could not have spread so far northward at that early date.

Hwen-Tsang, the Chinese pilgrim, is the earliest writer to mention the statues. In later times, they have been described by travelers, who had given them little more than a passing notice. Among these may be mentioned Burnes, Mohun Lal, who accompanied Burnes, Masson, and Sir Vincent Eyre—who was one of the prisoners in the first Afghan war. The latest notice is that of Dr. Yavorski, who accompanied Stoletieff's mission to Cabul in 1878, and has published an account of the mission in Russian. These writers have generally done little more than repeat the local traditions respecting the place, which are chiefly of a Mohammedan kind. The statues are known in the present day as Sal Sal and Shah Mameh, and the Bacheh, or child. The Hindoos, of which there are a few scattered about in Afghanistan, have also their own legends regarding them. All wonderful things in art or nature in India they attribute



BAMIAN STATUE. STATUE OF LIBERTY. SPHINX.

COMPARATIVE HEIGHT OF FAMOUS STATUES.

to the work of *Panch Pandu Ke Bhai*, or the Five Pandu Brothers; and, of course, according to their ideas, the great figures at Bamian could only be produced by these heroes of the Mahabharata.

There are five statues at Bamian; three of them are in niches, which have been cut out, the figures being formed of the rock within the niche. The largest statue has been produced in this way. Its size has been variously estimated by travelers, some putting it at 100 ft., and others as high as 150 ft. Captain Talbot used a theodolite, and found that all previous estimates had been short of the truth. The figure is 173 ft. high, which is only 29 ft. lower than the London monument, the exact measurement of it being 202 ft. The Nelson column in Trafalgar Square is 176 ft., just three feet higher than the Bamian figure, and thus giving almost an exact counterpart of its height. If a general meeting of all the colossal statues of the world could be brought about—if the Memnon figures from the banks of the Nile could come (they are 51 ft. high, and would be taller if they could stand up out of their seats); the four Great Guardians in front of the Temple of Ipsambul (these are also sitting figures, about 50 ft. high); the bronze Dai Bootz of Japan; if we can imagine to be reproduced for the occasion the statue of Athene, made by Phidias for the Parthenon, which was 39 ft. in height; or the Olympian Jupiter of the same artist, 60 ft. high, a statue celebrated for its great size as well as for its perfect workmanship; or even the still greater Colossus of Rhodes, the records of its height varying from 100 ft. to 120 ft.; if all these—and they are all well known to fame—were to meet at one place, and the almost unknown Bamian statue were to appear among them, what pygmies most of them would then seem! The colossal Apollo of Rhodes, one of the Seven Wonders of the World, would lose all pretense to superiority in height as he had to look up 53 ft.—at the lowest estimate—to the gigantic strangers from Bamian. The new "Liberty" statue at New York is 111 ft. high, but the distance to top of torch is 151½ ft.

The Chinese pilgrim estimated the height of the largest statue as 140 or 150 ft. In all probability it was originally gilt, for, in his short description of it, he says: "Its golden hues sparkle on every side, and its precious ornaments dazzle the eyes by their brightness" (Professor Beal's translation). Captain Talbot says that the folds of the drapery have been laid on with stucco. Local tradition asserts that when the soldiers of Timur, who were Mohammedans, passed on their way to the invasion of India, they shot arrows at the idols; and that the troops of Nadir Shah fired artillery at them. This is to account for the dilapidated condition of the lower limbs of the figure. It will be noticed that there are small holes in the broken parts; these are supposed to have been made for wooden pegs to support mortar or stucco, which had been used in repairing the defects. As the Mohammedans would most willingly destroy such objects of idolatry, we must suppose that the efforts to restore the figure must have taken place as early as the time of the Buddhists. At the feet of the statue there are entrances, which communicate with stairs and galleries, so that the top of the figure can be reached.

Hwen-Tsang distinctly states that it is a figure of Buddha. This is of some importance, because it has been suggested that the figures belonged to the pre-Buddhist period. Captain Maitland's drawings are quite sufficient to determine this point, and the Buddhist character of the figure need no longer be a question of doubt. There is the well known knob on the top of the head, the long ears, and the drapery arranged in folds, which all know who are familiar with Buddhist art. The influence left by the Greeks of Bactria, and which is so manifest in all the Buddhist remains in the Peshawur district, as well as in the Jelalabad valley, seems to be wanting at Bamian, or at least is so slight that it scarcely attracts notice. This is strange, as it might be expected that the farther north from India, the greater would have been the Greek influence.—*Illustrated London News.*

STATUE OF BAMIAN—LARGEST IN THE WORLD—HEIGHT, 173 FEET.

MANY farmers trust too much to luck and the moon, and do too little close figuring, thinks the *Empire State Agriculturist.*

ENGINEERING INVENTIONS.

A hydrocarbon burner has been patented by Mr. Lewis B. White, of New York city. It is primarily for burning crude petroleum for steam boilers, and combines with the boiler a steam jacket with a retort, a tank, and steam jet apparatus for converting the residuum from the retort into spray, in a way that is intended to avoid overheating of parts of the burner.

A muffler for steam valves has been patented by Mr. Thomas E. Hill, of Rahway, N. J. It has such perforations and slots to retard and subdivide the steam that there will be little hissing and disagreeable sound, and the steam so acts as to raise the valve and permit the escape of steam, if desired, beyond the capacity of the boiler to generate.

MECHANICAL INVENTION.

An outlining tool has been patented by Mr. Robert A. MacKenzie, of New York city. It is a tool designed particularly for carpenters' use in the work of dressing doors and similar pieces of stuff to their frames, to secure a perfect fit without the necessity of frequently setting the door up in the frame to test it as the work proceeds, and for similar uses.

AGRICULTURAL INVENTIONS.

A corn sheller has been patented by Mr. Asahel H. Patch, of Clarksville, Tenn. It is so made that, the ears of corn being put in a hopper, and a crank turned, the teeth of a wheel cause each ear to revolve and carry it down, spiral ribs engaging the surface of the ear and controlling the speed while the teeth remove the kernels from the cob, the machine being simple, light, and inexpensive.

A derrick for loading and stacking hay has been patented by Messrs. Thor O. Thorson and Peter S. and Michael W. Peterson, of Elliott, Ill. It is adapted for use in connection with a hay wagon, and also for general use as a derrick, and may be operated either by hand or horse power, the invention covering improvements in the construction and combination of the several parts.

MISCELLANEOUS INVENTIONS.

A carpet stretcher has been patented by Mr. Charles R. Gincley, of West Chester, Pa. This invention provides an implement designed to stretch the carpet to place and there hold it by a tack carried by a magnetized plunger, arranged to be forced downward by a properly mounted lever.

A table has been patented by Mr. Harley A. Barnhart, of Adelphi, O. This invention relates to extension tables formerly patented by the same inventor, and provides that the extra leaves will have direct support from the floor by an independent leg, thereby making the table more substantial.

A fur skirt has been patented by Messrs. Phillip Weinberg and Louis Clark, Jr., of New York city. The invention covers a novel form of a garment to be supported at the waist, having a fly at the waist placket, and a waist band with an adjustable fastening, so that the garment will fit persons of different sizes.

An exercising machine has been patented by Mr. John A. Smith, of New York city. It is a device by which the operator can lift weights attached to a rope by pulling in any direction upon handles, the pulley over which the rope passes turning easily on a swivel, the weight to be lifted being readily adjustable.

A pencil sharpener has been patented by Mr. Thomas A. Henderson, of Natchez, Miss. Combined with a sliding and rotating pencil holder is a spring-supported plate having an abrasive surface, with other special features, whereby both the wood and the lead of the pencil may be rapidly reduced to the required form.

A hand sled has been patented by Mr. Herman Lindenberg, of Jersey City, N. J. This invention consists principally in providing the sled with a sliding bar having penetrating points for forcing the sled forward as the rider draws backward upon handles attached to the sliding bar, making a practical self-propelling hand sled.

A kneading machine has been patented by Mr. James F. Hughes, of Georgetown, Texas. Its construction is such that the flour, seasoning, etc., may be placed in a tray or receptacle, when the operator turns with one hand a crank arm rotating a rod in the receptacle, and with his other hand turns the receptacle in various ways until the dough is thoroughly kneaded.

A tank has been patented by Mr. Antonio O. y Ponce, of Brooklyn, N. Y. It is for water closets and similar uses, and, being connected with a water supply pipe, is intended to fill itself automatically and discharge any desired amount of water into the basin when the operator actuates a lever or arm controlling the basin discharge cup.

A piston packing has been patented by Mr. John W. Dudley, of Portland, Ore. Bevel faced split metallic rings are held between opposite fixed and movable heads of the piston, and an elastic packing placed within said rings, and tending to force them outward, making a simple and efficient packing, which may be readily tightened, and will have an elastic bearing.

A drag saw has been patented by Mr. Cornelius W. Wright, of Democracy, O. It is so constructed that U-shaped irons on the end of the beam engage the log, and prevent vibration during sawing, and as the saw travels through the log it can be adjusted to the depth of cut by a lever, so that it will constantly move substantially upon a level.

A draught equalizer has been patented by Mr. John L. Powles, of Goodland, Ind. This invention covers an arrangement of levers, yoke, and a chain, etc., especially adapted for four horses, though the number is not limited, and by which side draught will practically be obviated, and the draught apportioned to the animals according to the work and their strength.

A beer faucet has been patented by Mr. John Walsh, of New York city. It has a metallic stock and peculiarly fitted and readily inserted rubber tube, the whole being so designed, in various novel features of construction, that the liquid will be kept from coming in contact with the metal of the faucets and contaminated thereby.

The manufacture of artificial leather or leather cloth forms the subject of a patent issued to Messrs. William V. Wilson, of Jubilee St., Middlesex Co., and Joseph Story, of Lancaster, Eng. It is for a new article of manufacture, a fabric coated with the residuum from a solution of mononitro-cellulose in acetate of amyl, in admixture with oil and a pigmentary matter.

A dental articulator gauge has been patented by Mr. Josiah B. Crist, of Hummelstown, Pa. It is a metal plate of elongated and tapered form, which has an arc bar with graduated marks, the device being adapted for measuring the approach of the gums when the mouth is closed, to indicate what length teeth are to be used, in putting in new ones, to preserve the comfort and symmetry of the mouth.

The manufacture of white lead forms the subject of a patent issued to Mr. William E. Harris, of New York city. Certain proportions of carbonate of soda and sublimed lead are well mixed in a tank with a due amount of water for about five hours; the top liquid having been drawn off, the lead is washed again with water, and afterward put in an evaporating furnace to finish its preparation.

A baling press has been patented by Mr. Joseph L. Gilbert, of Lebanon, Ore. The invention covers a novel arrangement of the baling chamber, and a novel way whereby the rope through which the power is applied is automatically locked in place when the power is relaxed; also in a new form of knotter adapted to operate on cords or wires held by a special kind of spools, with various other novel features.

An automatic attachment for stove or range dampers has been patented by Mr. Isaac A. Abbot, of Denver, Col. Combined with the damper is a vessel with trunnions, having brackets with slots for the trunnions to ride in, a piston and a spring, with a mechanism for establishing a connection between the damper and a piston, whereby the heat of ovens or other portions of a stove may be regulated.

A hose nozzle holder has been patented by Mary Lane, of Hot Springs, Ark. A turn table, with clamps for locking it in position, is mounted on a support, uprights projecting from the table, and a shaft journaled in their upper ends, to which the hose holder is secured, with a set screw for locking the shaft in position, whereby the nozzle may be easily held for directing the stream in any direction.

A burglar alarm has been patented by Mr. Charles H. Dowden, of Newark, N. J. It consists of two sliding metallic buttons, each in a metallic shell attached to the window jamb, a metallic strip being on one edge of each window sash, with wires, each attached to a shell and connected with a battery, and a device for giving the alarm, which will continue to sound as long as the sashes are out of proper position.

A cop winding machine has been patented by Mr. George H. McCausland, of Philadelphia, Pa. The invention covers a novel construction and arrangement of parts of a machine, which can be readily adjusted to suit and wind fine, coarse, and all grades of yarn, it being possible to cop all kinds of yarn by simply changing the speed of a shaft and the up and down movement of a cross piece.

A wagon tongue has been patented by Mr. George W. Avery, of Fort Ransom, Dakota Ter. A socket is fitted to the end of the tongue, with a notched end in which the neck yoke ring is received, and a spring-acted bolt for closing the notch, a rod connected with the bolt extending nearly the whole length of the tongue, by which the neck yoke ring is securely held, or may be readily released by moving a handle at either end of the tongue.

A fence machine has been patented by Mr. Robert F. Deering, of Washington, Kansas. The machine is mounted on a frame, and has hollow twisting spindles, connected by gear wheels, each spindle having rectangular arms, each carrying a wire reel, there being a tension device, and various other special features combined in a novel way, for making a combined wire and picket fence of any desired height and length.

A sash balance has been patented by Alois Lang and Thomas W. Talbot, of Florence, S. C. A pivoted lever, with one end adapted to be connected with the object to be counterbalanced, has a spring connected to its opposite end, to adjust along the same near the fulcrum, so that when compressed it will exert the greatest force on the lever, the device being also applicable as a counterbalance for weights, or in gasometers, and for other purposes.

A vehicle spring has been patented by Mr. Edward Bowman, of Santa Cruz, Cal. The spring has slots in its ends, a socket with downwardly projecting pins, a wearing plate, and a clip for securing the socket to the axle, with other novel features, the arrangement being such that the heavier a vehicle is loaded, the nearer the center will be the bearing of the spring, the rigidity being increased according to the load.

A vertical draught attachment has been patented by Mr. George W. Wheater, of Ogdensburg, N. Y. There is a series of transverse pivoted deflecting plates below the grate, links pivotally connecting the plates beyond their pivoted points, and a rod for adjusting the plates at any desired angle, the device being applicable to almost any form of furnace, in order to distribute the draught more equally throughout the length of the fire.

A process of and apparatus for manufacturing concentrated extract of cod livers has been patented by Messrs. James W. Stairs and John Craig, of Halifax, Nova Scotia, Canada. The apparatus comprises a steam-heated vat, evaporating pan, filter, and press, and the process is designed to make an extract soluble in water, and readily assimilated, which shall have all the valuable properties of cod liver oil without the fat or oil.

A check receiver has been patented by Mr. John Casey, of Jersey City, N. J. It is for receiving and holding checks of metal, celluloid, or other suitable material, as used in making payments of small amounts in many kinds of business, and holds a number of checks in view before they are finally discharged into a receiver, the invention being an improvement on formerly patented inventions of the same inventor in this line.

A brick machine has been patented by Mr. William Thaison, of Austin, Texas. The mould wheel has six, eight, or more radial mould cavities, in each of which is fitted a plunger, and for each revolution as many bricks are made as there are cavities, the cavities and plungers being shaped according to the shape of the bricks desired, the invention covering various novel features in a machine which will occupy but little space and produce a large number of bricks in a short time.

An apparatus for preparing wood and other fibrous material for conversion into pulp has been patented by Mr. Franklin B. Erwin, of Elkhart, Ind. This invention relates to apparatus in which sulphurous acid is used in treating the fiber, and covers a method of producing the acid in the digester under pressure, there being in connection with the digester a furnace for burning the sulphur, a pump for drawing the fumes from the furnace and forcing them into the digester, means for producing a circulation, and various other special features.

Special.

NEW YORK CITY—THE EXPERIENCE OF MR. HETTRICK.

There was a time in the history of New York when the whole provision business of the city centered in Washington and Fulton Markets. These markets were queer old collections of tumble-down sheds, and, to speak as mildly as possible, were not an ornament to the city. They have within a few years been rebuilt, and are now spacious and elegant. But much of the provision business has scattered itself around town among the stores of the green-grocers, and a great deal of it has gone to certain new markets which have been built up-town. One of the most elegant of these markets is the "Central," at Broadway and Forty-eighth Street. For convenience and for perfect cleanliness it is a model market. Passing through it we find, among the butter and produce men, Matthew Hettrick, Esq., one of the largest dealers in butter and cheese in the city. Mr. Hettrick has grown up in the business, and is thoroughly familiar with every detail of it.

Although Mr. Hettrick had long been a prosperous butter merchant, he was for many years severely annoyed with catarrh, bronchitis, and dyspepsia. A combination like this is enough to make any man miserable.

To our New York correspondent, Mr. Hettrick gave an account of his diseases and his recovery.

"For twenty-five years I had a great deal of trouble with my head and throat. I had both catarrh and bronchitis, which were not only annoying, but very painful. I was treated by the regular doctors, and by specialists who give their whole attention to these diseases. But neither the regulars nor the specialists did me any lasting good. I must have inherited these diseases, for two brothers of mine also had them, and died of them. I am nearly sure that one of these brothers could have been saved, had he taken in time the remedy which has now restored me to health."

"And may I ask what that remedy is, Mr. Hettrick?"

"It is what they call Compound Oxygen. About a year ago I heard of this—I had seen it advertised. First, I sent to Philadelphia for it—the headquarters. Then I found they had an office here on Fifth Avenue—No. 148—and I got a treatment or two there, together with a good deal of advice from the physician in charge. Did it do me good? Well, you see me now; you ought to have seen me before I took this Compound Oxygen. My catarrhal discharge was very profuse. My voice was hollow. I was suffering about equal distress from the catarrh and the bronchitis, and added to these was the distress of the dyspepsia. Every little cold I caught would make me worse. I am exposed to a great deal here in the market, where I spend much of my time. There are draughts in all directions, and in raw weather, when doors are constantly opening and shutting, it is enough to give a well man consumption or pneumonia.

"Three days after I began to inhale Compound Oxygen my voice became better, and I was much encouraged by seeing that there was a chance for me to mend, generally. I was surprised and gladdened to see how soon the Oxygen did its work on the catarrh. It was not a mere drying up of the discharges. That I had had before, by the aid of some of the specialists; but let me tell you what a man needs who has catarrh. He wants all the organs of his head and throat put in such healthy condition that the discharges don't come. That is what Compound Oxygen did for me. I can't account for it except on the theory that this remedy strengthened and built up my whole system. It certainly helped me out of all these three troubles together, and at about the same time—catarrh, bronchitis, dyspepsia. My recovery was steady; I was gaining all the time. Sometimes, if I caught cold, I would lose a little, but I always gained more than I lost, and so I went on until I got to where you see me now."

"Well, Mr. Hettrick, you now look like a perfectly well man."

"That is exactly what I am, abating only a little for wear and tear, and considering what I endured for so many years. Once in a while I find I have a little catarrh left, and sometimes I feel a little inconvenience from an attack of indigestion. But these things are trifles compared with what I used to suffer. My general health is very good. I can stand all the duties of my business. I can bear exposure to the weather. I eat pretty much what other folks eat, and I have a fair appetite; and I think people who see me would not take me for a man who had been sick."

A remedy which can thus drive out such a three-fold combination of twenty-five year old disorders as catarrh, bronchitis, and dyspepsia is something of which every invalid ought to know. Compound Oxygen works such wonders that all people, sick or well, should read the interesting little brochure about it which is published and mailed free of charge by Drs. Starkey & Palen, 1529 Arch Street, Philadelphia. Also several other works on chronic diseases.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Wanted—20 inch throat boilermakers' punch and shear in good order. S. P. Hedges, Greenport, N. Y.

Mechanic's Own Book. Full instructions for drawing, casting, founding, forging, soldering, carpentry, carving, polishing wood and metals, turning, roofing, etc. 702 pages; 1,420 illustrations. $2.50, post paid. E. & F. N. Spon, 35 Murray St., N. Y.

Railroad Engineer's Transition Curves. A simple and rapid method for laying out. By B. H. Hardaway. With transit book combined. Price, $2.00. E. & F. N. Spon, 35 Murray St., N. Y.

Texas.—Ice Factory, Cotton Gins, Corn Mill; all run by water power. Heirs wish immediate sale. Address W. G. Jones, 113 East 14th St., New York.

Protection for Watches.
Anti-magnetic shields—an absolute protection from all electric and magnetic influences. Can be applied to any watch. Experimental exhibition and explanation at "Anti-Magnetic Shield & Watch Case Co.," 18 John St., New York. F. S. Giles, Agt., or Giles Bro. & Co., Chicago where full assortment of Anti-Magnetic Watches can be had. Send for full descriptive circular.

Walrus Leather, Emery, Glue, and Manufacturers' Supplies generally. Greene, Tweed & Co., 83 Chambers St., New York.

Wanted—Patented novelties to manufacture on royalty, or would purchase patent outright. Household or articles in general use preferred. Address, with full particulars, Hardware, Plantsville, Conn.

Complete Practical Machinist, embracing lathe work, vise work, drills and drilling, taps and dies, hardening and tempering, the making and use of tools, tool grinding, marking out work, etc. By Joshua Rose. Illustrated by 356 engravings. Thirteenth edition, thoroughly revised and in great part rewritten. In one volume, 12mo, 459 pages. $2.50. For sale by Munn & Co., 361 Broadway, New York.

Blake's Improved Belt Studs are the best fastening for Leather or Rubber Belts. Greene, Tweed & Co., New York.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

Concrete patents for sale. E. L. Ransome, S. F., Cal.

Machinist Foreman wanted who can handle fifty men to advantage and increase their production by latest improved ways of doing work. Address P., care of Wilkinson & Co., 352 Atlantic Ave., Boston, Mass.

Friction Clutches from $2.25 on. J. C. Blevney, Newark, N. J.

Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

A Catechism on the Locomotive. By M. N. Forney. With 19 plates, 227 engravings, and 600 pages. $2.50. Sent on receipt of the price by Munn & Co., 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other mach'ne tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Wrinkles and Recipes. Compiled from the SCIENTIFIC AMERICAN. A collection of practical suggestions, processes, and directions, for the Mechanic, Engineer, Farmer, and Housekeeper. With a Color Tempering Scale, and numerous wood engravings. Revised by Prof. Thurston and Vander Weyde, and Engineers Buel and Rose. 12mo, cloth, $2.00. For sale by Munn & Co., 361 Broadway, New York.

"He Never Smiled Again!"
No "hardly ever" about it. He had an attack of what people call "biliousness," and to smile was impossible. Yet a man may "smile and smile, and be a villain still," still he was no villain, but a plain, blunt, honest man, that needed a remedy such as Dr. Pierce's "Pleasant Purgative Pellets," which never fail to cure biliousness and diseased or torpid liver, dyspepsia, and chronic constipation. Of druggists.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Best Automatic Planer Knife Grinders. Pat. Face Plate Chuck Jaws. Am. Twist Drill Co., Meredith, N. H.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Rubber Belting, all sizes, 77½ per cent regular list. All kinds of Rubber Goods at low prices. John W. Buckley, 156 South Street, New York.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co. 419 East 8th Street, New York.

Cushman's Chucks can be found in stock in all large cities. Send for catalogue. Cushman Chuck Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Send for free Catalogue of Books of Amusements, Speakers, Dialogues, Card Games, Fortune Tellers, Dream Books, Debates, Letter Writers, Etiquette, etc. Dick & Fitzgerald, 18 Ann St., New York.

60,000 *Emerson's* 1886 ☞ Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Safety Elevators, steam and belt power; quick and smooth. D. Frisbie & Co., 112 Liberty St., New York.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 95 John St., N. Y

Cutting-off Saw and Gaining Machine, and Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) W. K. writes: The question came up a few days ago here, How far would one million silver dollars reach, they being laid down side by side, touching each other? This we found would be 23 miles 118 yards and 2 feet. Then the question was asked, How large a circle would the one million dollars make, laid the same as above? Some claim it cannot be worked out accurately. Bringing them into a circle, they will lose some of the above length. The question we ask you to decide is how much of the above length would they lose? A. The coins will form a circle whose perimeter will be slightly less than the length of the straight line, in the ratio of the chord of 180° (or diameter) to the chord of $\frac{360°}{1{,}000{,}000}$—

This is most easily solved by the rule of the square of the hypotenuse, taking the diameter of the circle as the hypotenuse, one millionth part of the semi-perimeter as altitude, and the third side to be solved as the chord. This only involves the error of assuming an arc of 1°296″ to coincide with its sine, which error is infinitesimal for all ordinary dimensions. Then, solving the triangle, we find the perimeter of the circle of dollars would be to the straight line of dollars in the ratio of 999,999,999,995,609 to 1,000,000,000,000,000, or about $\frac{6}{1{,}000{,}000}$ of the diameter of a silver dollar.

(2) E. S.—Turpentine varnish is simply clear, pale resin dissolved in oil of turpentine.

(3) E. F. F. asks: How can I clean a fine chromo which has become dirty and fly specked, also what kind of varnish shall I use to varnish it? A. Keep a wet towel lying on its face till the dirt is thoroughly softened, say 3 or 4 days, occasionally rubbing off carefully with a sponge; then rub with clear nut or linseed oil.

(4) M. B. B. asks: 1. Is the daily use of soap injurious to the skin, as is often said? A. No; but to not thoroughly rinse and dry the hands makes the skin rough. 2. What kind of soap is the most healthy? A. The purest is the best, and white castile is generally recommended by the doctors. 3. Is there anything to remove freckles? A. It is often quite difficult to remove freckles. The following has been recommended: 1 drachm each of white precipitate and subnitrate of potash in one ounce of glycerine ointment. This is to be applied in a thin layer every other night for from four to six weeks.

(5) M. L. asks: What will take the dirt off book leaves without injuring the printing? A. Besides the ordinary use of bread crumbs, for the removal of stains, a solution of oxalic acid, citric acid, or tartaric acid may be used; these acids do not attack printing ink, but will remove marginal notes in writing ink, etc.

(6) J. T. asks why objects appear in- verted on the ground glass of a photographic camera. A. Because the rays of light from the bottom of the object pass in straight lines through the lens, crossing its axis, and continue upward until they reach the upper side of the ground glass. The rays from the top of the object pass downward, and strike the bottom of the ground glass. See Ganot's Physics for further explanation.—To clean brass, use oxalic acid and water.—Goodman & Wightman, Boston, Mass., will make small engines for you.

(7) J. L. O. asks: 1. Which President of the United States first issued a Thanksgiving proclamation, and in which year? A. George Washington, in 1789. 2. After once issued by the President, was it any following year omitted? If so, which, and by whom? A. The second Thanksgiving proclamation was issued in 1795, by George Washington. 3. Was a Thanksgiving proclamation made by any governor before same was issued by any President? And if so, by whom? A. Occasional Thanksgiving days were appointed by the Dutch governors of the New Netherlands in 1644, 1645, 1655, and 1664; and by the English governors of New York in 1735 and 1760. Regular annual recommendations of a thanksgiving day were prevalent in the New England States from a very early period, but the custom did not extend throughout the Union until within the last thirty years.

(8) G. Z. asks (1) how to kill or keep roaches away? A. Use borax or Persian insect powder. These must be renewed frequently, as they deteriorate by exposure to the air, and lose their power. 2. How to remove printer's ink from a tin can? A. Use benzine or caustic soda.

(9) W. W. W. asks if there is any pre- paration which, applied to windows, will prevent their frosting. A. Covering the glass with a thin coat of glycerine is the simplest method; where there are objections to this, make a double window, with a ventilating chamber between the glass walls.

(10) C. H. asks for a recipe for making javelle water. A. Add carbonate of potash to a solution of chloride of lime, with agitation as long as a precipitate forms, the liquid being afterward decanted or filtered.

(11) S. G. D. asks for a method of tin- ning brass, and if there is a way to tin a brass shell on the inside and nickel-plate same on outside. A. See the article on the "Tin Plating Process," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 310, under the title of "Electro-Metallurgy."

(12) B. W. B. asks: Which plan is the most efficient for heating workshops—steam pipes around the walls at the floor, or steam pipes overhead just under the ceiling? A. In workshops and factories where the side walls are clear for the reception of pipes, the wall coils near the floor are the most efficient, and generally preferred for equal distribution of heat. There are many workshops and factories in which the wall spaces are occupied with machinery, benches, or goods. In such the hanging system is much in vogue, and is considered very efficient.

(13) R. B. asks (1) how to take grease stains out of paper. A. Oil stains may be removed from paper by applying pipe clay, powdered and mixed with water to the thickness of cream; leave it on for four hours. 2. I have some bronze, and would like to know how to make some glue to use on anything I want to bronze. A. Ordinarily, a coating of common sizing will do, but it depends largely upon the article you desire to have bronzed. We would advise you to consult Spons' "Workshop Receipts," first series, which we can send you for two dollars.

(14) "Information."—A structure along or over a marsh is often more correctly styled a causeway than a bridge. The Tay Bridge, Scotland, is 3,000 yards long. A railroad bridge over the Volga is 1¾ miles long. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 256. The Garabit in France is 413 feet high. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 391. The Kinzua viaduct is 301 feet high. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 369. The St. Gothard tunnel 48,840 feet long. The Mt. Cenis tunnel 37,840 feet long.

(15) P. H. R. asks: 1. Where is a good school to study mining engineering? A. There are schools of mining engineering in Ann Arbor, Michigan; Golden, Colorado; Rolla, Missouri; and in New York city. 2. What is the proper preparatory course to pursue? A. This information can be best acquired from the catalogues of the institutions referred to. One essential requirement is a thorough knowledge of mathematics. 3. A receipt for a tooth paste that does not contain pumice stone. A. Take ordinary charcoal and beat it up with pure honey; or powdered willow charcoal 1 part, cinchona bark and sugar of milk in powder each 4 parts; add transparent soap in powder 1 part. Mix in a mortar, sift through bolting cloth, and perfume.

(16) J. F. asks: What is the process for etching on steel shears? A. Etching upon cutlery is done by printing the design or lettering with a rubber stamp, using as ink a wax composed of equal parts asphalt, Burgundy pitch, and beeswax, melted and thoroughly mixed. Place some of the wax upon a smooth plate of iron, warmed so as to just melt the wax. Use a small pad to distribute the wax evenly, as in printing. Warm the cutlery just enough to receive the print without spreading. Charge the rubber stamp and print the device, or paint all parts of the piece not required to be etched with a varnish of asphalt and turpentine. In either case, when dry, dip for a few seconds in a bath of 1 part nitric acid, 4 parts of water. Then dip in boiling hot water, wipe dry, and remove the traces of wax and varnish with turpentine. The rubber stamp may be made for bright letters or device on etched ground. The rubber-stamp makers can make the stamp. Any special device will have to be engraved, from which the rubber stamp can be made.

(17) C. A. A. asks as to the connections between an engine and boiler. The boiler is 80 feet from engine, and the question is as to the best way to make the connection, whether by steam pipe laid in a box underground or by a pipe (well covered) overhead. A. It matters not whether steam pipe is placed above or below, as long as the most direct connection is made, and in a way to take care of the expansion and contraction of the pipe. The water condensing in the pipe or foam from the boiler will not run back while the engine is running. When not running, the overhead pipe, if properly inclined, will return the water of condensation to the boiler. There is no exception to the necessity of a drip pipe close to the engine valve for clearing the pipe of all water before starting, whether it is above or below. In all events, the most convenient way with a proper drip discharge near the engine is the best, and with thorough felting of the pipe is the most economical. A wrapping of sheet asbestos covered with one inch hair felting and canvas, painted, loses but very little heat.

(18) H. R. T. asks: 1. What is the greatest distance the telephone described in SUPPLEMENT, No. 142, will work? A. The magneto telephone described in SUPPLEMENT, No. 142, will, if on an isolated line, work over 3 or 4 miles of wire. 2. How many square feet of surface (cast iron plate) will it take to ground the wire? A. It depends on the moisture in the ground. A plate one or two feet square, and bedded in charcoal in damp soil, is enough. 3. How much pressure will best wrought iron pipe with malleable fittings stand (air), and how much steam? Is there any difference in steam pressure and air pressure? A. Allow a strength of 500 pounds to the square inch for butt-welded pipe of best description, for either air or steam pressure. Steam is no more disastrous in exploding a pipe than air, except for its heat.

(19) G. S. W. asks: 1. Would you please inform me how to make a hard alloy that can be easily melted on an ordinary fire and that would be suitable to make a small model? A. A hard alloy suitable for casting is made of 80 pounds lead and 20 pounds antimony. 2. Also is the wire part of No. 16 covered electric wire the same size as No. 16 uncovered wire? A. The wire part of No. 16 wire is of the same size, whether covered or uncovered.

(20) H. S. S. inquires what talcum vene- tum and glass gall (sandiver) are. A. The first, probably Venetian talc, which is the same thing as soapstone or French chalk. Sandiver is skimmed off the surface of glass while in fusion.

(21) F. P. asks how to make cider brandy. A. Ordinary brandy is distilled from grape wine. If you distill cider instead of wine, you have cider brandy. Caramel or burned sugar can be added to color.

(22) H. A. W. writes: 1. A house is in- fested with red ants. How can they be removed? Powdered borax and Cayenne pepper have been used without effect. A. A strong solution of carbolic acid and water poured into holes kills the ants it touches. Lime and chalk are also recommended. 2. What will prevent grass from growing between the bricks in a side yard? A. Use common salt in the crevices.

(23) E. W. asks a receipt to make a cement that will stand considerable heat after it is cooled. A. Mix a handful of quicklime in 4 ounces of linseed oil; boil to a good thickness; then spread on thin plates in the shade, and it will become exceedingly hard, but may be easily dissolved over the fire, and used as ordinary glue.

(24) W. B. asks for receipt for flour paste that will not sour under a reasonable time. A. Mix smoothly flour and water till a thin batter is formed; put in a pinch of pulverized alum, and pour in boiling water until a thick paste is formed. Let it boil a minute or two; add a few drops of carbolic acid or oil of cloves. Put in a wide necked bottle. The oil of cloves acts as a germicide, and prevents the growth of mould.

(25) J. K. wants to know how to make prints from the plate sold with the "Ready Fotographer." A. After the negative is developed, fixed, and dried, place it film side upward in a photographic printing frame and put in contact with the plate a piece of ready sensitized sensitive silver paper. Then expose to the sun until the picture is printed out. The paper is removed, toned, and fixed. Duplicates can be made to any amount. The frame, paper, and other materials can be had from any photographers' supply house.

(26) C. J. H. asks how to make a dye for coloring hair—one that will be black as soon as the operation is complete, without waiting several hours for the sun to produce the change. A. An instantaneous hair dye, contained in two bottles, consists of the following: *a*. To 1 ounce pyrogallic acid add 1 quarter ounce of tannin, dissolved in two ounces of alcohol. Add 1 quart of soft water. *b*. To 1 ounce of crystallized nitrate of silver, dissolved in one ounce concentrated aqua ammonia and one ounce soft water, add one-half ounce gum arabic and 14 ounces soft water. Keep the mixtures in the dark. The hair must be thoroughly cleansed of all grease, then every part dampened with mixture *a*, all surplus moisture being removed, so there will be no dripping, when the mixture *b* must be applied with great care, and so as not to touch the skin.

(27) J. M. B. asks a receipt for making the "Elixir of Calisaya" that is sold in the drug stores. A. Take of quinine sulphate 72 grains, cinchonine sulphate 24 grains, quinidine sulphate 20 grains, cinchonidine sulphate 12 grains, elixir of orange 128 fluid ounces, and of caramel a sufficient quantity to color. Triturate the mixed sulphates with 1 pint of the elixir, pour the mixture into a glass flask, and heat in a water bath until the solution is effected. While still hot, add the remainder of the elixir and caramel; when cold, filter.

(28) B. B. asks (1) how to dye or stain white and faded stag horn or buck horn to black. A. 0·14 ounce of silver is dissolved in 2·1 ounces nitric acid (aqua fortis). This solution must be applied several times to the article to be stained, but it is absolutely necessary that one coat should be dry before another is applied. 2. To a dark red color necessary for coloring knife handles? A. Take 17·5 ounces red Brazil wood, and boil for 1 hour in 4·4 milk of lime, and filter through a cloth. The articles to be stained are boiled for an hour in a solution of 1 ounce alum to 17 ounces water. They are then placed in the dye, and allowed to remain until the desired color is produced.

(29) G. C. asks how to make orange wine. A. The English pharmacopœial name is vinum aurantii, and it is made by the fermentation of a saccharine solution to which the fresh peel of the bitter orange has been added. It contains about 12 per cent of alcohol, and is but slightly acid to test paper.

(30) R. L. asks (1) a receipt for making common black blasting powder. A. Ordinary blasting powder consists of 15 parts of carbon, 20 parts of sulphur, and 65 parts of saltpeter. 2. Is blasting powder best adapted for splitting timber and stumps? A. Various preparations of nitro-glycerine are used for this purpose.

(31) A. B. C. asks for a quick method of cleaning and brightening the brass fixtures of a railway coach. A. Brass may be cleaned with sweet oil and tripoli, powdered bath brick, rotten stone, or red brick dust, rubbed on with flannel and polished with leather. A solution of oxalic acid rubbed over tarnished brass with a cotton rag soon removes the tarnish, rendering the metal bright. The acid must be washed off with water, and the brass must be rubbed off with powdered whiting and soft leather.

MINERALS, ETC.—Specimens have been received from the following correspondents, and have been examined, with the results stated.

H. D. S.—The mineral is a limestone of no value.

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AND EACH BEARING THAT DATE.

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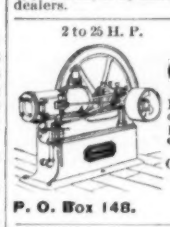
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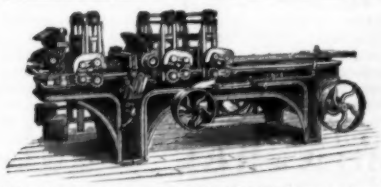

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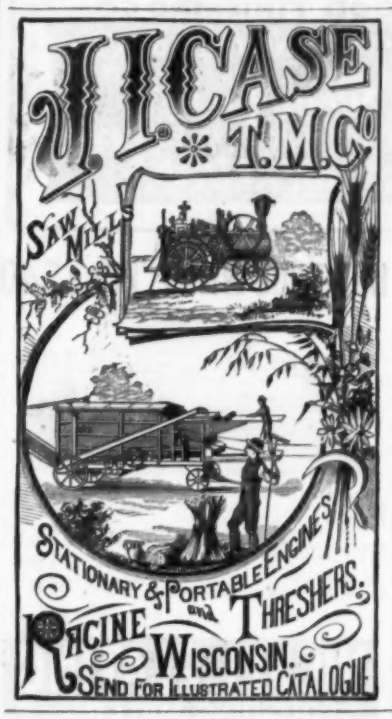

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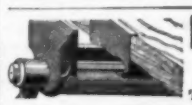

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TO THE STEEL MANUFACTURERS OF THE UNITED STATES OF AMERICA.

UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., Aug. 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engage to produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bids are hereby invited for supplying this Department with the under-mentioned material:

About 1,310 tons of steel gun-forgings, of which about 226 tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 912 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

6-inch	3¼ tons.
8 "	5 "
10 "	9½ "
10½ "	9½ "
12 "	12½ "

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 28 within one year, and the remainder within 18 months.

For 8 inch guns, within two years.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4½ feet by 6 inches thick.

There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests, which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordnance, Navy Department, Washington, D. C.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 15th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.

First. Gun Forgings.

Second. Armor-plate.

And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

WILLIAM C. WHITNEY,
Secretary of the Navy.

NOTICE.
NAVY DEPARTMENT,
WASHINGTON, *November* 5, 1886.

The time fixed by the foregoing advertisement, dated August 21, 1886, for receiving proposals for steel gun-forgings and armor-plates, viz.: December 10, 1886, is extended to 12 o'clock noon, March 15, 1887, at which hour the opening of the bids will take place.

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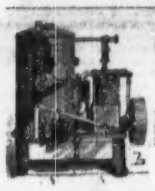

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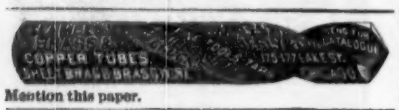

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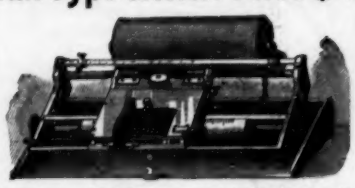

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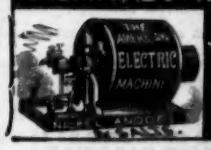

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